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SPECTACULAR ELECTRICITY.

The dispatches from London describing the ceremonial of the coronation of King Edward mention the interesting fact that at the moment when he assumed the crown all the electric lights in Westminster Abbey flashed out in their full brilliancy, with great effect. The idea was an admirable one, and it is to be inferred from the reports that it was carried out with all the smoothness and precision that characterized the other proceedings of that great event. We can imagine that in some quarters the effect may be criticized as theatrical, but looked at fairly and squarely, the coronation was as truly a theatrical performance as any that could well be attempted on histrionic boards. It is the fact that a coronation is a religious ceremony, but lots of kings and queens get along very nicely without it, and are just as effective in their various functions as rulers. Considering the joyousness and gladness of such an occasion as that which has just taken place in the old Abbey, we are glad to see the electric light used to illuminate its dusty splendor, and add eclat to the celebration. This use of electricity at the antique rite was fully as appropriate, and quite as essentially modern, as the use of electric fans in the King's bedroom to mitigate the heat as he lay suffering so patiently and bravely in the dense heat of midsummer. While there are kings and queens, the world will largely look to them for guidance and leadership in setting the fashions, and we feel, personally, very much obliged to King Edward for his willingness to use electric lights and electric fans, and to have electric elevators installed in his palaces for the sake of comfort and convenience.

THE ELECTRICAL EXPORT TRADE.

The June summary of the commerce and finance of the United States, issued by the Bureau of Statistics, of the Treasury Department, gives the complete export figures for the year. The general totals have already been noted, showing a lower volume of exports and a slight increase in imports, but leaving still a substantial balance of $478,392,330 of goods exported; while of the imports a growing quantity consists of raw material to be worked up in manufactures. In view of the failure of the corn crop last year, and the great domestic demand for manufactured products, the results are very satisfactory. This year there are bumper harvests, with an increase in the quantities of agricultural produce available for export; but probably the briskness of home consumption will act as a check on the export of surplus manufactured goods.

In the branch of electrical exports the figures are good, but exhibit the effect of the establishment abroad of large plants to make American apparatus. It was hardly to be expected that exportations could long continue on the scale of a few years ago, in certain heavy lines, for it was inevitable not only that foreign manufacturers would give closer attention to newer demands but that foreign capital would invite Americans to establish plants. Hence, some of the largest factories in England and on the Continent to-day are largely American in origin, methods, personnel and product; and this being so, the export of the classes of apparatus affected must necessarily sustain some check. Turning to the figures themselves we find the export of electrical machinery for the year ending June 30, given at $5,379,746, as compared with $5,812,715 in 1901, while it is just about one million dollars more than in 1900. Of the product for 1901-2,

the United Kingdom took nearly one-half, and British North America nearly another quarter, and British Australasia one-ninth. Not to mention other parts of the British Empire, these figures show what excellent customers our English cousins are.

As to electrical instruments, including telegraph and telephone apparatus, the figures are not so clearly arrived at. Up to the present year all such apparatus was grouped indiscriminately with scientific apparatus. It is now being separated, and it appears that of a total $5,389,476 under the general heading, not less than $3,631,759 was the value of electrical appliances. This is not subdivided so as to show the countries buying, as in the former case; but of the total it again appears England and her colonies took about one-half. There is a wide range of apparatus included in this group whose details would be interesting, but it is at least something to have the electrical figures now taken separately on account of their growth and importance. From the above it will be seen that this country is doing an annual export electrical trade of at least $9,000,000 a year, a figure, we believe, to be susceptible of marked increase on account of the scale on which electrical apparatus is produced in this country, and its universal applicability without change of make or style.

Engineering Education.

It is a long-established truism that education cannot create, but that it can foster. *Poeta nascitur non fit* was the verdict rendered by public sentiment upon this question in the days of ancient Rome, and what is true concerning poets is more or less true concerning engineers. Engineers are born, just as poets, artists, musicians, and salesmen are born, and no amount of education can be expected to make a great salesman out of a born engineer, or *vice versa*. But education itself seeks not to determine congenital ability or natural talent. It appeals to the intelligence of the student regardless of capability. The average man of a given community has a perfectly definite statistical existence. He has a certain height, weight and girth in physical assessment, and a certain intelligence and capacity for acquisition in mental assessment. Education of a certain definite character is theoretically capable of bringing about a certain definite result in this average student, when the study is carried on for a certain specified time. In fact, the whole system of national education, considered on a large scale, is a purely mechanical and statistical process from this point of view.

As soon, however, as averages are departed from and picked students are selected, the entire problem is modified. A new set of statistical conditions applies to the new average formed by the selected students. These call for a different class of education and for a different period of its application. The results attained in the education of picked students are hopelessly incapable of parallel comparison with the results attained in the education of unselected students.

It is for this reason in particular that the curriculum of study in night schools is necessarily and essentially different from the curriculum of post-graduate students. The former tend to represent more nearly the average capabilities of the community at large. The latter tend to represent selected individuals culled from the ranks of successful students, who were again culled from classes that tended to attract men of special ability in that line of industry. If the class of students who attended night schools were statistically the same as the class of students that attend college—and particularly post-graduate courses—then the results achieved in night schools might approach those achieved in post-graduate education. In the night schools there are individuals of abilities as marked as any in college courses, but the average is necessarily different.

These views seem to be in accordance with Mr. Hines's article in this issue. That article points to the desirability of having suitable courses of education open to the great mass of the workers in electrotechnics. This is, undoubtedly, sound principle. Education is unquestionably the need and the spirit of the age. There is no class of workers in the whole world that cannot be benefited by it. The difficulty is to ascertain the statistical condition of each class and to determine the particular kind of education adapted thereto. To the great majority, correspondence schools, night schools and manual-training schools are best adapted. By continually lessening numbers, in any country at any one time, higher educations, with the corresponding tax upon time and subsistence, are demanded for producing the best results.

Block Signals on American Railroads.

Although the automatic block signal systems which have been developed for use on American steam railroads have depended so much upon electricity for their operation, block signal engineering has from its nature been so apart from other lines of electrical engineering that the average electrical engineer probably knows less of automatic electric block signal practice than of any other branch of electrical development. An article on the subject, by Mr. E. F. Bliss, which is given in this issue, cannot by any means be considered a complete review of automatic block signal practice, but it will serve to give a clear outline of some of the more important features of present automatic block signal practice to those not conversant with this increasingly important branch of electrical work. The automatic electrical block signals coming into such extensive use in America may be considered as somewhat in a line with other American automatic labor-saving appliances. American railroad engineers have not been content to confine themselves to the expensively-maintained manual block system, requiring operators for each block station, and the automatic block system, which has in consequence been developed, has resulted not only in a saving of operating expenses on lines which would otherwise require a manual block system, but has also made it possible, financially, to put block signals on many more miles of road than could otherwise have been protected.

Automatic block signal work in America dates back to the experiments of Thomas S. Hall, in 1866. The progress of the first 20 years was exceedingly slow. Until 12 years ago the use of the track circuit, now so universally used for the operation of signals, was limited, and generally considered as an uncertain experiment when tried. As the requirements of track circuits became better understood, the difficulties before experienced were reduced to such a point that the track circuit now has the field almost to itself. Indeed, it is upon the track circuit that much of the reliability and simplicity of our present block signal systems depends, and it is to be regretted that owing to the use of the track as a return circuit, electric railways operating on the surface are prohibited by practical considertions for using track circuits for automatic block signaling. At the present time railroad practice has virtually settled down to two accepted forms of signals—the semaphore and the enclosed disc. The semaphore has the advantage of giving more unmistakable indications by day, while the enclosed disc, owing to the small amount of electrical energy taken to operate it, has the advantage of economy of operation and maintenance. For a number of years the only automatic semaphore available was the electro-pneumatic type, which required compressed air for its operation, and the expense of which was prohibitive for many miles of road which could, however, afford the less expensive enclosed disc. Within the past five years the semaphore operated by an electric motor has been developed, and

railroads now have the choice between the electrically-operated enclosed banjo or disc and the electrically-operated semaphore signal, at a slight increase in cost over the disc.

The evolution of a thoroughly reliable electric semaphore motor mechanism has taken some time because the problem is, by no means, a simple one, and even the apparatus of to-day is somewhat complicated. The question has been, not how to devise a motor mechanism that will operate a semaphore signal, but to secure such economy in the apparatus as to enable it to be operated from primary batteries located at each signal, and at the same time be absolutely certain that signals will never stick in the clear position. The counterweight on a semaphore, which acts to return the signal to danger position, may be considered as one of the factors of safety of the signal. Reduction in this factor of safety means reduction in the amount of electrical energy required to force it to the clear position. All of the inventive efforts, therefore, have been directed towards means for reducing the counterweight the signal must carry by reducing the various elements of friction which necessitated heavy counterweighting. It is on this point that the greater part of the skill and design and workmanship has been expended. The prosperous times of the past few years have stimulated immensely the work of equipping railroad lines with automatic signals, which previously were unable to earn a surplus sufficient to make improvements of this kind; and these roads are now taking advantage of increased earnings to equip with block signals. Every improvement in the block signal field which tends to put automatic block signals within the reach of more railroads, so that a greater mileage can be equipped, is most beneficial in its results, adding as it does to the safety of the thousands who travel, by removing the uncertainties which accompany the train dispatching system.

STEAM VS. ELECTRIC LOCOMOTIVES.

We are glad to note that the cause above mentioned, which has been argued with all the fervor of an impending prize fight, is, according to recent reports from Berlin, about to come to trial again on the now famous Berlin-Zossen line. When the electric trials came to a close for the time being by reason of the failure of the track, a prize contest was inaugurated by the German Society of Mechanical Engineers, looking to the confusion of the electrical contingent. The specification calls for an engine and train having a capacityy for 100 passengers, to be capable of a speed of 75 miles per hour for three consecutive hours without stops for fuel or water. This of itself would appear to be a most insignificant feat from the standpoint of the American engineer, for with a train of so small capacity as that demanded, almost any first-class express locomotive from one of our big trunk lines would make light of the task. But in the German test, economy of fuel is to be an important feature, and the trials are to be upon the same track which failed at the high speeds reached by the experimental electric cars. A recent publication in the U. S. Consular Reports gives some details of the plans which are of considerable interest. In view of the air resistance found by the electric tests it is proposed to box in the entire train so as to form a species of flexibly-jointed sheet-steel projectile, with sharp point and smooth sides. This is the familiar shape affected by the high-speed promoter for some years past, and we shall be glad to see the old friend really materialized and in operation. It is commendable on general principles for either steam or electric service.

The design of the projected locomotive is evidently intended to get there. In addition to providing a heating surface double that of the standard German locomotive, the locomotive is to be three-cylinder compound with external low-pressure cylinders and a central high-pressure cylinder. The attempt is to secure very great steaming capacity with usual economy of fuel, so as to obtain the requisite speed with the smallest possible weight and resultant strain on the track. The weight is to be spring supported in the softest possible manner to reduce the strains on the track. The projectors of the outfit seem to have a fixed delusion that the high electric speeds failed on account of lack of flexible supports for the weights; and they do not propose to be caught in the same way if they can possibly escape. They have not yet devised any method, so far as we are informed, of abolishing the hammering of the reciprocating parts, which is the feature of steam locomotives; but, perhaps, they hope to reduce it by careful balancing for the proposed rotative speed. It strikes us that they need not worry much about attaining the required speed, but unless we mistake, they will have plenty of fun with the track unless it is greatly improved over its condition during the electric trials. Of course, the comparatively light engine will help matters materially, but it is no joke to run over a light track at double the usual speeds for which the track was to be used.

And supposing the feat were accomplished successfully, what of it? To our minds the steam experiments are putting the cart before the horse. They are deliberately designing a light locomotive to run on a bad track at a speed which otherwise would not be safe, instead of building as good a track as possible and trying for speeds high enough to be worth the while. Seventy-five miles per hour for three hours is an easy mark on any good American line with a reasonably straight and level track. With a locomotive and train especially planned for the purpose, the problem involves no material difficulties whatever. And supposing the new experiment is capable of operating even on the Berlin-Zossen line where the electric cars were run, what of it? Unless a speed much greater than 75 miles per hour is reached, the conditions of the test will not be comparable with the results obtained from the electric trains. It is, of course, a desirable thing deliberately to build a high-speed train for the purpose of finding out what can be done by refinements of design, but to be of practical value the speed aimed at should not be less than 100 miles per hour. Seventy-five miles per hour is not enough higher than present speeds to be of any great importance. As we have many times pointed out, the value of really fast running lies in covering long distances at very great speed, so as to effect a valuable saving of time. For example, we do not think that a 20-hour train between New York and Chicago is materially better than a 24-hour train, save as it may gratify a very human taste for a hot pace. In either case practically a day and a night are required to complete the journey. Reduce the running time to ten or twelve hours, however—a mere night's run—and an entire business day will have been saved; so that the gain involved is important. In the same way, a shortening of running time sufficient to convert a half day's trip into a couple of hours is most useful.

We are glad to have a really serious effort at the development of a steam locomotive for great speeds, but the present attempt does not go far enough. However successful, it proves nothing for or against the electric method of propulsion. The Berlin-Zossen trials were made with a very heavy and powerful equipment, so powerful that at the highest speed that the track allowed, the motors were barely half loaded. If the motors had been built for 75 miles per hour instead of 125, and the whole equipment had been correspondingly light, there would have been a different story to tell. The electric trains got into track trouble at just about the speed for which the steam locomotives are planned, so that if the latter succeed, their victory will be a most unsubstantial one. And if they do not make the speed, we shall be ashamed of German engineering, for which we usually entertain most sincere respect.

Juries and Awards for the St. Louis Exposition.

The special rules and regulations providing for an International Jury and governing the system of making awards at the Louisiana Purchase Exposition, at St. Louis, were promulgated last week by President Francis. They represent a great deal of careful research and much correspondence, many persons in other cities having been consulted. It was the desire of the Exposition authorities to secure the best outside advice obtainable as to a number of the matters under consideration, and the completion of the work was delayed somewhat in consequence.

The total number of jurors in the International Jury of Awards will be approximately two per cent. of the total number of exhibitors, but not in excess of that number, and each nation having 50 exhibitors or more will be entitled to representation on the jury. The number of jurors for each art or industry and for each nationality represented, will as far as practicable, be proportional to the number of exhibitors and the importance of the exhibits. Each group jury will be composed of jurors and alternates. The number of alternates will in no case exceed one-fourth of the number of jurors, and they will have a deliberative voice and vote only when occupying the places of absent jurors. The United States jurors and alternates of the group juries will be nominated by the chiefs of departments to which the respective groups belong. The jurors and alternates of the group juries representing foreign countries and the United States insular possessions will be nominated by the commissioners of such countries.

There will be department juries, to consider carefully and review the reports of the group juries, to harmonize any differences that may exist between the recommendations of the several group juries as to awards, and to adjust all awards recommended so that they will be consistent with the rules and regulations. Twenty days may be devoted to this work, and when the awards recommended by the group juries have been adjusted, the department juries will, through the chiefs of their respective departments, sumbit their findings to the Director of Exhibits, who shall, within ten days after the receipt thereof, certify the same to the superior jury, including such work as may have been left incomplete by the department jury.

The officers and members of the superior jury will be as follows: President, the President of the Louisiana Purchase Exposition Company; 1st vice-president, the Director of Exhibits; 2d vice-president, a citizen of the United States, to be named by the National Commission; 3rd and 4th vice-presidents, the Commissioners-General of the two foreign countries having the largest number of exhibitors. The members of the jury will further consist of the chairman and the 1st vice-chairman of the department juries, the chiefs of the exhibit departments, and one person appointed by the Board of Lady Managers.

A special award, consisting of a gold medal in each department, may be recommended by the department jury, for the best, most complete and most attractive installation.

The following scale of markings will be used in determining the final merits of an exhibit and fixing the award that should be made, 100 being used as indicating perfection: Exhibits receiving markings ranging from 60 to 74, inclusive, bronze medal; exhibits receiving markings ranging from 75 to 84, inclusive, silver medal; exhibits receiving markings ranging from 85 to 94, inclusive, gold medal; exhibits receiving markings ranging from 95 to 100, inclusive, grand prize.

The diplomas or certificates of award for exhibitors are to be signed by the President of the Louisiana Purchase Exposition Company, the President of the Louisiana Purchase Exposition Commission, the Secretary of the Louisiana Purchase Exposition Company, the Direcor of Exhibits and the chief of the department to which the exhibit pertains.

Special commemorative medals and diplomas may be issued to the officers of the Exposition, to the United States, State and Foreign Commissioners, to the members of the International Jury of Awards, and to such other persons as may be deemed worthy of special recognition.

The superior jury will determine finally and fully the awards to be made to exhibitors and collaborators in all cases that are formally presented for its consideration. Formal notification of the awards will, in each case, be sent by the president of the jury to the exhibitors to their respective exhibits.

If, for any reason, an award is not satisfactory to an exhibitor, he may file written notice to that effect with the president of the jury within three days after the official notification of the award; and this notice must be followed, within seven days after the date of the official notification, with a written statement setting forth at length his views as to wherein the award is inconsistent or unjust.

Pacific Cable Conditions.

We printed last week the conditions proposed by President Roosevelt for the privilege of landing the Pacific commercial cable on American shores. The reply of the Commercial Cable Company will not be made for a month or more. Mr. George G. Ward, the manager of the Pacific Cable Company, and the person best acquainted with the situation, is in London, and will not return until the middle of September. Mr. Clarence H. Mackay is also abroad.

According to Mr. George Clapperton, the traffic manager of the Commercial Cable Company, the only stipulation which is really irksome and capable of affording a source of serious disagreement, is the condition that an additional cable be laid between the Philippine Islands and China. This extension of the line demanded by President Roosevelt is particularly objectionable because the company already has entered into an agreement with the persons controlling the existing line between Manila and China; this arrangement was intended to give the Pacific Cable Company an outlying spur without the necessity of laying another cable. "This condition," Mr. Clapperton states, "if complied with, would entail a large extra expenditure on which we had not reckoned. The others are either insignificant or can be easily adjusted. The term providing that only American citizens shall be employed in the operation of the cable meets with our approval, but practical obstacles stand in the way of our immediate compliance with it. There are very few Americans who are prepared to serve as operators, and at the start foreign recruiting will be necessary. Even if we should establish a school to train operators, the benefit would be slow and small. The work requires unusual skill and intelligence, and I should venture to state that out of a school of 100 about 5 per cent., and no more, would be competent to enter the service."

Automobile Guarantees.

Motor vehicle makers of this country have adopted a standard form of guarantee. It has been under discussion by the members of the National Association of Automobile Manufacturers for several months.

The guarantee, as finally promulgated by the association's executive committee, is as follows:

We warrant all goods furnished by us for 60 days following the date of their shipment, based upon the date of invoice covering the goods; this warranty being limited to the replacement in our factory of all parts giving out under normal service in consequence of defect of material or workmanship.

If the circumstances do not permit that the work shall be executed in our factory this guarantee is limited to the shipment, without charge, of the parts intended to replace those acknowledged to be defective.

It is, however, understood that we make no warranty whatever regarding pneumatic tires or the batteries.

We cannot accept any responsibility in connection with any of our motor cars when they have been altered or repaired outside of our factory.

We are not responsible to the purchaser of our goods for any undertakings and warranties made by our agents beyond those expressed above.

We wish it distinctly understood that we make no warranty of our goods except as stated above, but desire and expect that customers shall make a thorough examination of our goods before purchasing.

The N. A. A. M. executive committee also announces that it has completed negotiations with the management of the next British show in London for an American exhibit, under the auspices of the association, whereby members can show sample vehicles at a very moderate total expense, including transportation.

Modern Electric Block Signaling.

BY E. F. BLISS.

AS traffic becomes heavy on double-track lines so that trains are run closely together some device must be used to keep them a safe distance apart. The device commonly used is the block signal, so called because it is placed at the entrance of a block; a block being simply a portion of the track varying in length according to the physical conditions of the country and the number of trains to be handled. The length is usually from ½ to 2 miles.

There are two patterns of block signals in common use to-day, the semaphore blade and the disc. A semaphore blade is about 4½ feet long and 7 inches wide, placed at the top of a mast about 25 feet high which stands near the track. (Fig. 1.) The blade always extends to the right of the mast as seen from an approaching train. When the blade is in the horizontal position it indicates "stop," or "danger." When inclined at an angle of about 45° it indicates (according to the rules of most roads) "clear" or "safety." At night the two positions are usually indicated by red (danger) and white (safety) lights respectively. A second blade on the mast about six feet below the first one is frequently employed as a "caution" or "distant signal." When this blade is in the horizontal position it indicates that the top blade or "home signal" at the next signal post in advance is in the "stop" position, and that the engineer must be prepared to stop his train before reaching the next signal. When the lower or distant signal blade is inclined it indicates that the top or "home" blade on the signal ahead is also clear. At night the two positions of the distant signal are shown by green and white lights respectively. The end of the stop blade is usually square, while that of the caution blade is forked.

On some roads instead of a semaphore post with two blades there is one "three-positon" blade in which the horizontal position indicates stop, an angle of 45° caution, and a vertical position clear. The Pennsylvania Company was the first to adopt the three-position semaphore. In the three-position semaphore, the cost and maintenance of one blade, lamp and working apparatus is saved. The cost of oil and care for the semaphore lamp is about $12 a year. All semaphore blades are counter-weighted so that in case any part of the apparatus breaks, the blade will go at once to the horizontal position.

FIG. 1.—UNION ELECTRIC SEMAPHORES.—HOME AND DISTANT SIGNALS ON SAME POST.

THE HALL DISC SIGNAL.

One of the cheapest, simplest and most reliable electric signals is the Hall disc signal, (Figs. 2 and 3.) which is used by a large number of railroads. In this signal the indication is given by a colored disc instead of a semaphore blade. The disc, which is about a foot in diameter, is made by stretching colored silk over an aluminum wire frame; lightness of moving parts being of prime importance in this design. This disc is placed on one end of a lever,

FIG. 2.—HALL DISC SIGNAL.—HOME AND DISTANT SIGNALS ON SAME POST.

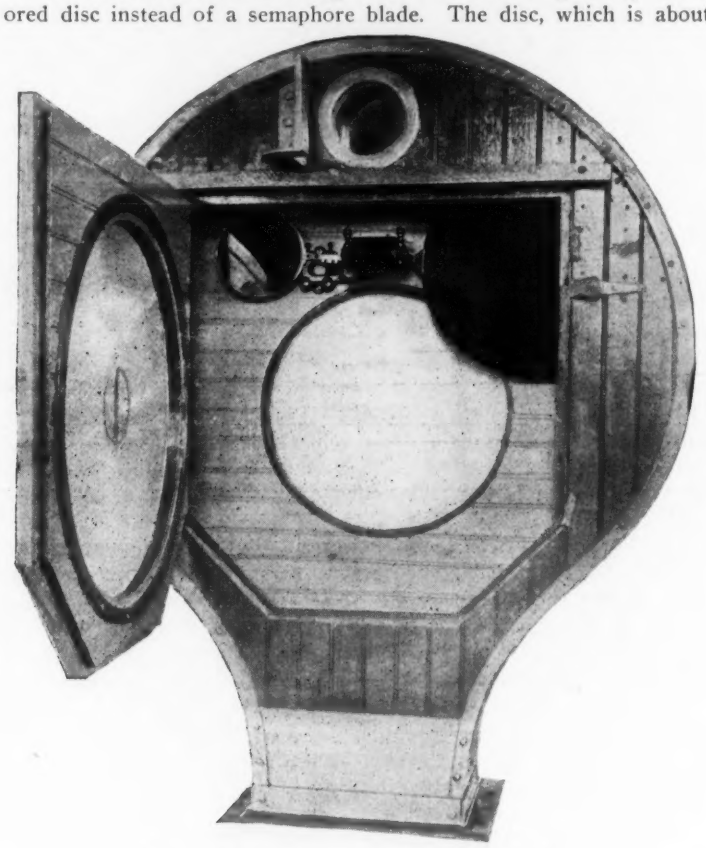


FIG. 3.—HALL DISC SIGNAL.—INTERIOR.

while the other end carries a small disc of colored glass. The lever is mounted near its center of gravity upon the armature of an electromagnet of about 35 ohms resistance. The whole apparatus is enclosed in a large weatherproof case.

When the magnet is deenergized the silk disc hangs behind a round glass window in the case, while at the same time the colored glass covers a small window just above the first one and in front of the lamp which gives the night indication. When the magnet is energized the lever turns upon its axis until the silk disc is raised away from the window and the colored glass moved away from the lamp. This is the clear position and shows a white background behind the window in the place of the colored silk. When the lever reaches the clear position the 35-ohm magnet is cut out of the circuit and one of 500 ohms is cut in. This high resistance magnet is sufficient to hold the signal in the clear position. These signals are mounted on iron or wood masts, and the red above the green, as in Fig. 2, if home and distant are on the same pole.

CIRCUITS FOR HOME AND DISTANT, NORMALLY CLEAR SIGNALS.

One form of track circuit used with a system of home and distant Hall disc signals is shown in Fig. 4. In this, *A, B* and *C* represent three block stations. The rails of the track are all bonded at the joints save at each block signal station, where one joint in each rail is insulated. A small battery *D*, called the track battery (consisting usually of two gravity cells in multiple) is connected between the rails at the forward end of each block. At the beginning of the block a track relay *T* is connected to the rails in a similar manner. When there is no train in the block, the current from the track battery circulates down one rail, through the coils of the track relay and back through the other rail. The armature of the track relay, the magnet of the red home signal *R*, and the signal battery *S*, form a second circuit by which the signal is held at clear when the track circuit is closed.

The direction of train travel is from the bottom to the top of the diagram, as indicated by the arrow. Now, when a train or even a single pair of wheels passes *A*, the current from the track battery at the end of the block *A, B*, will be short-circuited, flowing through the wheels and axles instead of through the track relay. The armature of the track relay immediately falls, which breaks the circuit of the signal battery, and the signal goes to the "stop" position by the force of gravity. As soon as the last pair of wheels has passed *B*, the circuit is restored through the track relay at *A*, the armature of which closes the signal circuit and causes the disc to go to the clear position. After the train has passed *C* the track relay at *B* closes the circuit of its own red signal and also a circuit which runs back over the telegraph poles to the caution signal at *A*, bringing it to the clear position.

If an engineer approaches a block station and sees both signals clear he knows there are at least two unoccupied blocks ahead of him. If the red or home signal is at clear, but the green one is not, he knows there is a train in the second block ahead. If the home or red signal is at danger he knows there is a train in the next block ahead. In Fig. 4, a train is in the block beginning at *C*, as is shown by the position of relay and signals. It is often preferred to have the distant or green signal indicate caution when the red signal on the same mast indicates stop. This is easily arranged by having the circuit of the green disc run through a pair of contact points opened and closed by the lever of the home signal.

CIRCUITS FOR THE OVERLAP BLOCK.

Fig. 5 shows an arrangement which is sometimes used in the place of a distant signal or caution blade of the semaphore. The signal at station *A* does not go to the clear position when the train passes station *C*, but only after it has passed *D*. The distance between *C* and *D* is sufficient for a train to stop when running full speed. An engineer finding the signal at *A* in the danger position, knows that there is a train somewhere between *B* and *D*. This overlap block is especially useful in single-track blocking, as will be seen.

CIRCUITS FOR SINGLE-TRACK BLOCKING.

Fig. 6 shows an arrangement of circuit for single track blocking. Each block is divided near the middle and a track battery connected to each part, as shown. When a train passes into block *A, B*, the track relay *F* opens the circuit controlling the signal at *E*, which allows it to go to the stop position and warn any train that may be approaching from the opposite direction. When the train passes *B*, relay *G* opens and the signal at *B* goes to the stop position, opening a switch, *S*, on the signal rod which holds the circuit to *E* open through *F* to be closed. In this way the circuit to *E* will be open until the signal at *B* goes to the clear position, which, with this overlap block arrangement will not be until the train has passed *E*. It will be seen that on the track just passed over by a train the signals in the rear work exactly as in Fig. 5, and at the same time the train keeps the first two signals ahead of it which govern the opposing train, in the stop position at all times. A train running from *E* to *A* will control the signals at *B* and *D* in precisely the same manner.

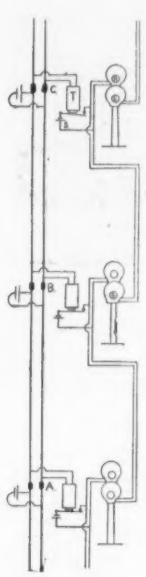


FIG. 4.—CIRCUITS FOR HOME AND DISTANT NORMALLY CLEAR SIGNALS.

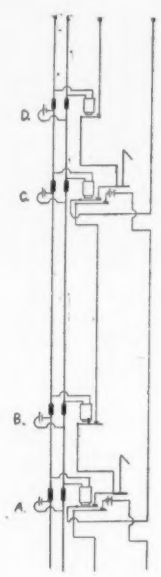


FIG. 5.—A CIRCUIT FOR THE OVERLAP BLOCK.

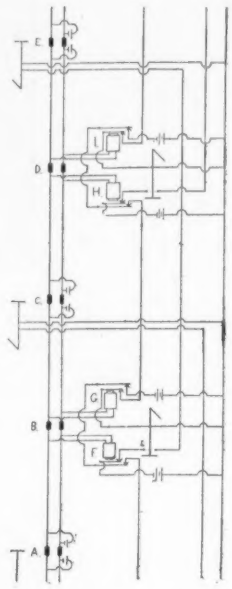


FIG. 6.—CIRCUITS FOR SINGLE-TRACK BLOCK SIGNALS.

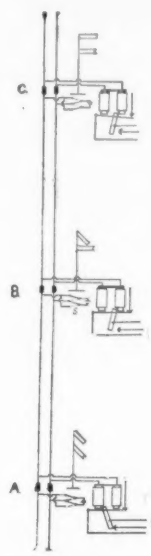


FIG. 7.—CIRCUITS FOR UNION WIRELESS DISTANT SIGNALS.

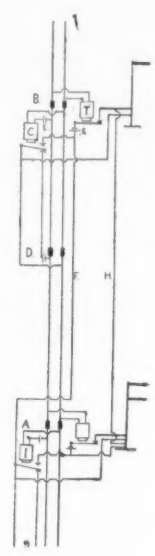


FIG. 8.—ONE OF THE CIRCUITS FOR NORMAL DANGER SIGNALS.

CIRCUITS OF UNION "WIRELESS" SYSTEM.

The Union Switch & Signal Company works its caution or distant signal through the track circuit, which does away with all line wires. The track relay has, besides the ordinary neutral armature, a polarized armature which closes the circuit for the caution signal. When the top blade at *B*, Fig. 7, goes to the clear position, the signal rod throws a pole changing switch *S*, which reverses the direction of the current in the track running back to *A*. This reversal of currents through the relay at *A* causes the polarized armature to close the circuit *D*, which extends through a battery and to the mechanism of the caution blade at that station, bringing it to a clear position.

NORMAL DANGER SIGNAL CIRCUITS.

All of the circuits shown thus far are for signals operated on what is known as the "normal clear" plan. That is, the signals always stand in the clear position except when there is a train actually in the block. There is another system called the "normal danger" in which the signal always stands in the stop position until a train comes in sight of it, when, if the block ahead is clear the signal will go to the clear position and stand there until the engine is past. Fig. 8 shows one arrangement of circuits for working "normal danger" signals. The signal circuit at *B* passes through the armature of the track relay *T* and the battery *S* in the regular manner, and also through the armature of relay *C*, called the clearing relay. This clearing relay is controlled by a battery, *E*, the circuit of which is short-circuited when there is a train between *D* and *B*.

When a train passes *D*, the signal circuit of *B* is closed by the armature of *C*, when, if the block ahead is clear, the armature of *T* will be closed, making a complete circuit through the signal at *B*, which will go to the clear position. As the train passes *D* the signal at *A* is still held in the stop position by the armature of *C*, which holds the battery at *D* open until the train has passed entirely out of the block at *B*. Line wires *F* and *H* pass through the battery *S*, armature of *T* and back to *A*, where circuit is completed through

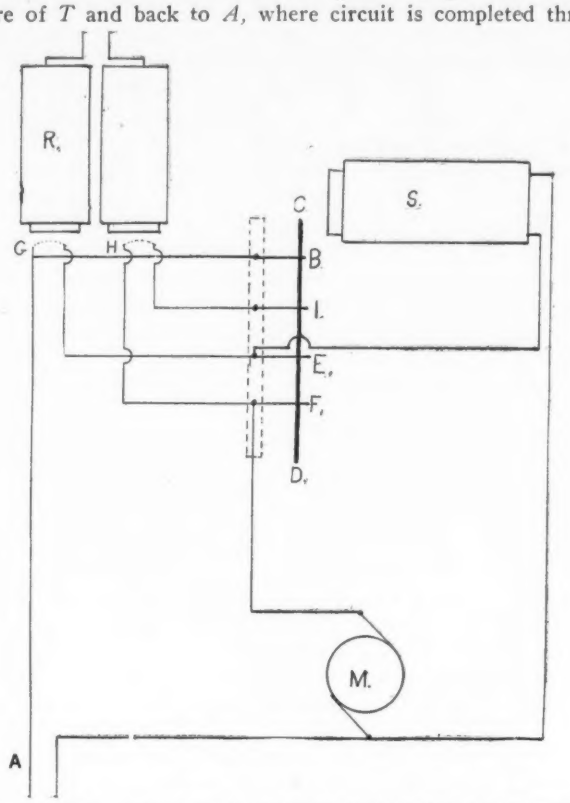


FIG. 9.—CIRCUITS OF THE GRAY ELECTRIC SEMAPHORE MECHANISM.

the mechanism of the caution or distant signal and the armature of the clearing relay *I*. In this manner the distant signal at *A* will clear when a train approaches it if the block ahead of *B* is clear.

There has been considerable discussion of the relative merits of the two systems of signaling. Advocates of the "normal danger" plan claim a great saving in cost of battery material to hold the signals at clear and freedom from the liability of the signal sticking or freezing in the clear position. Advocates of the "normally clear" plan claim greater simplicity, ease of inspection and a better chance to quickly locate and remove trouble when it occurs. As far as cost is concerned, it would seem that careful railroad managers do not consider the moderately higher cost of any equipment when once convinced that it is really better than something that can be had for less money. This is well illustrated by the way electric semaphores are being installed where the much cheaper disc signals could be used.

ELECTRIC SEMAPHORE SIGNALS.

The one great drawback to the disc signal is that it is purely a color signal. The engineer has to depend for his indication entirely on the color that is seen in the little window of the signal case. In hazy weather or smoky places or when the face of a signal does not reflect the light quite right it is very difficult to see the indications, especially when at some distance. The position of a semaphore blade can be seen as far as it is visible. This fact has led inventors to get out electric semaphores of several types.*

In the Gray signal, used on the Pennsylvania lines west of Pittsburg, a small electric motor of about 1-10-h.p. moves the three-position semaphore blade to the caution and clear positions. The mechanical and electrical parts are enclosed in a waterproof iron box which rests on the ground or on a bridge and supports the mast of the signal, which is a steel tube within which the up and down rod of the signal moves. The Gray signal uses the same kind of track circuit as was shown in Fig. 4. The electric circuits in the mechanism box at the base of the Gray signal are shown in Fig. 9. The wires at *A* are from the track relay and signal battery. When the track relay closes, the current from the signal battery flows from *A* to the contact maker *B*. This contact maker is a spring which presses against a metallic slider *C*, *D*. Part of the current passes through the spring *E*, around through the magnet *S* and thence back to the battery. Another part of it goes through the spring *F* and starts the motor *M*. The slider, *C*, *D*, and the magnet *S* (which has flexible connections) are fastened permanently to the lower end of the signal rod, which is hollow and and fits like a sleeve over a short lifting rod. The lower end of this lifting rod is a rack operated by a pinion from the motor through a train of gear wheels.

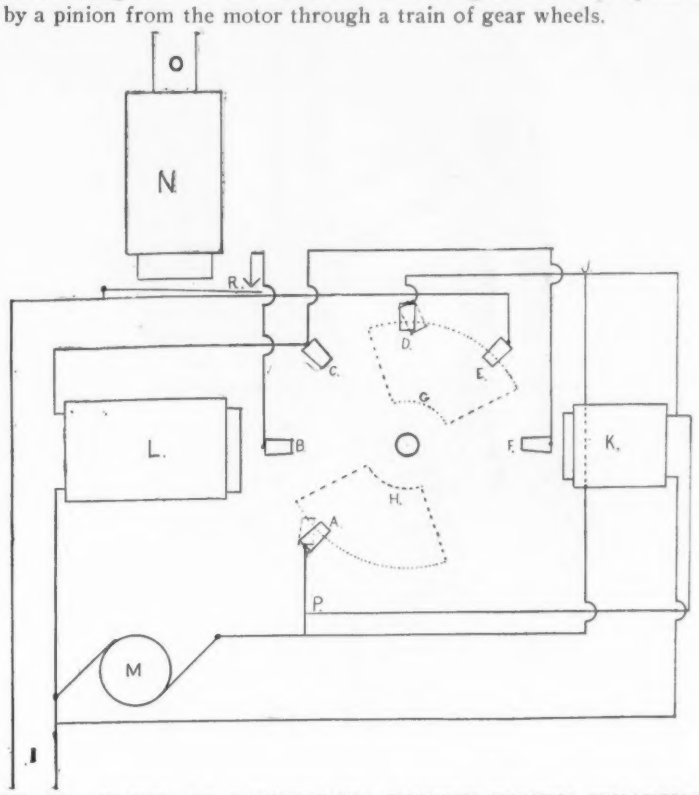


FIG. 10.—CIRCUITS OF PENNSYLVANIA IMPROVED ELECTRIC SEMAPHORE MECHANISM.

When the magnet *S* is energized it locks the signal rod to the rack and lifting rod and thus connects the signal rod to the motor through the rack, pinion and gearing. The motor raises the signal rod (which lowers the blade) until the bottom end of the slider passes *F* and breaks the circuit at that point. This opens the motor circuit, leaving the signal blade at the caution position, where it is held by a pawl and ratchet on one of the cog wheels. As soon as the track relay at the first station ahead is closed, the current comes back over the line wires and energizes the relay *R*, which closes the points *G* and *H*, as shown by the dotted arcs. The current now reaches the motor through the spring *I* and turns it until the end of the slider passes *I* and breaks the circuit as before. There is still contact at *G* which keeps the magnet *S* energized. The signal is now at the clear position.

When the circuit at *A* is broken by the opening of the track relay, the magnet S lets go of the catch which holds the signal rod to the rack and lifting rod. The signal rod, magnetic catch, and magnets fastened to it then fall and the semaphore blade goes to horizontal or danger position. An air dash pot is used to break the fall. To allow the rack and lifting rod to fall back to a position where they can again lift the signal rod to clear the signal, the pinion which

*For a detailed description of the Hall electric semaphore, see the ELECTRICAL WORLD AND ENGINEER of September 28, 1901.—ED.

meshes in the rack is of such size that it will lift the signal rod to full clear position on slightly less than ¾ of a revolution. One-fourth of the circumference of this pinion has the teeth cut out. When the motor starts with the rack elevated this blank quadrant on the pinion soon reaches the rack, which allows the lifting rod to drop down to its first position, where it is ready to lift the blade as before.

During the summer of 1901, the Pennsylvania Company brought out a new signal, very similar to the Gray, but greatly improved. The lower end of the signal rod is attached to a disc which is revolved by a motor through an angle of 90°, thus turning the semaphore blade through the same angle or from the stop to the clear position. Fig. 10 shows the electrical connections of this signal. The circuits are closed through the pieces *A, B, C, D, E,* and *F,* and the two quadrants *G* and *H*. These pieces fit snugly on both sides of the quadrant like a spring clothes-pin. When the track relay closes, the current enters the signal box at *I*, passes around to *E*, through the quadrant *G*, out at *D* to *J*, where it divides, part going to the motor *M*, and part to energize the clutch magnet *K*, which locks the disc mentioned above to the train of wheels from the motor. The magnet *K* has flexible connections and moves with the

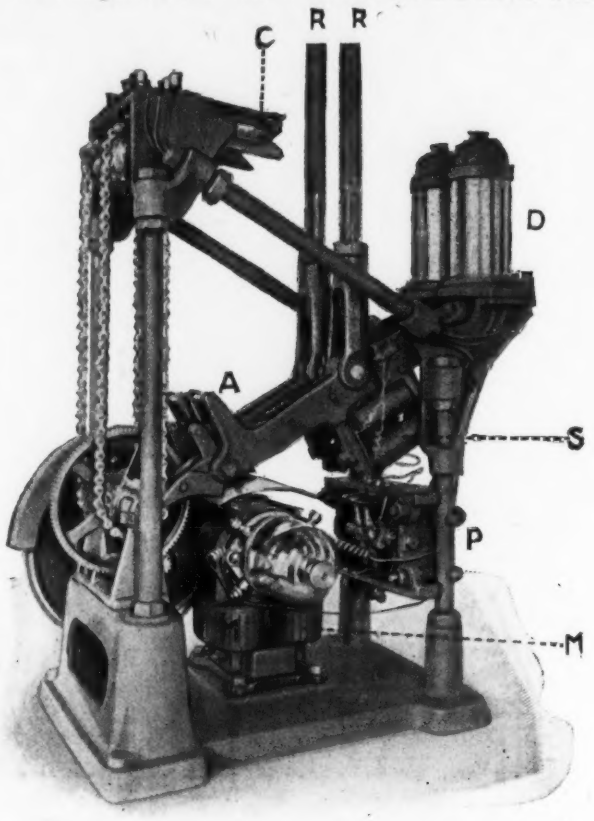


FIG. 11.—UNION ELECTRIC SEMAPHORE MECHANISM.

disc. The quadrants *G* and *H* are insulated from each other and are attached to the same shaft as the disc.

As the shaft revolves 45° clockwise the quadrant *G* makes contact at *F* and breaks it at *D*. Current now goes around through *C* to slot magnet *L*, which locks the disc and holds the blade in the caution position. At the same time quadrant *H* makes a contact at *B*. When the current at *O* energizes the magnet *N*, the current from *I* will flow through *R, B, H, A,* to *P*, where it divides between the motor *M* and magnet *K* as before. The quadrant and disc now revolve 45° further when contact is made at *C* and broken at *A* and *E*. Current through *R, B, H* and *C* now energizes magnet *L*, while all other circuits are open and the signal stands in the clear position. The two most important contacts, *A* and *D*, swing on pivots as the quadrant passes through them into the position shown by the dotted lines. When the quadrants finally leave them they spring back to the normal position, preventing sparking by giving a quicker and much wider break than would occur otherwise. This signal is especially economical in yards where there is much switching, since, if a switch be opened in the second block ahead, the blade will go at once to the caution position and be caught there. In the Gray signal it would first go to the stop position, when the motor would start and move it to the caution position. This new signal has a liquid dash pot which makes it work very smoothly.

THE UNION ELECTRIC SEMAPHORE.

The mechanism and motor of the electrically operated semaphore with home and distant blades (Fig. 1), made by the Union Switch & Signal Company is shown in Figs. 11 and 12. In Fig. 11, *M* is the motor, *R*, the signal rods, *P*, the pole-changing switch, *D*, the dash pots, *A*, the slot arm, *S*, the slot magnets, and *C*, the electric contacts. Fig. 13 shows the circuits of the Union electric semaphore as used with the Union "wireless" distant signal circuits described before and shown in Fig. 7. The signal, of course, can be operated on other than the wireless system, in which the pole changing switch is left off the signal.

Referring to Fig. 13, when the neutral armature of the track relay closes at *A*, current from the battery *B*, energizes what is known as the slow-acting relay, *R*, which, in turn, closes two circuits in parallel, one being formed by the part of the slot or catch magnet, *L*, and the other by the part, *Q*, and the motor *O*. Both parts of the slot magnet are wound upon the same cores. Most of the current goes through the motor circuit, since *L* is of 1000 ohms resistance. The magnet causes the slot arm by the series of levers and catch shown in Figs. 11 and 12, to engage with lugs on the sprocket chain, which chain is geared to the electric motor, and as the motor revolves the arm is raised and the signal cleared. When it arrives at clear position the point *C*, Fig. 13, is opened, by the movement of the signal, breaking the circuit through the motor but leaving *L* in circuit to hold the signal clear. At the same time the point *D* is closed, which leaves the motor and magnet *N*, ready for current as soon as the polarized armature of the track relay closes the point at *E*. When *E* closes, the caution blade is brought to the clear position by the motor *O*. Point *F* now closes and holds the blade clear while *H* opens the circuit through the motor and *N*. The slow-releasing relay *R* is wound with a regular coil of 1000-ohms resistance. Upon the same cores is also wound a closed coil of 2000-ohms. The effect of the inductance of this closed coil is sufficient to hold the points *K* closed during the very brief interval in which the circuit through the rails is changing direction.

THE MILLER SIGNAL.

During 1901, a few miles of the Chicago & Eastern Illinois Railroad out of Chicago were equipped with the Miller signal system, which is dfferent from anything else now in use. The indications of the Miller signal are given, not by a signal on a post beside the track, but by a lamp carried in the cab of the locomotive. Two small incandescent lamps, one white and the other red are placed side by side in the cab. Only one of them can burn at a time. As long as the white one is burning the engineer knows that the track is clear for at least two blocks ahead. If the red one lights up and the white one goes out, he knows that there is a train in the second block ahead. Fig. 14 illustrates the principle of this system.

The track is divided into insulated blocks with track batteries and track relays, such as have been described, the only difference being that a short block is left between the regular blocks at each block station. The block station equipment consists of this short block, the station relay and the station battery, no semaphore or disc signals being used. In Fig. 14 the lines at the left of the track represent the apparatus which is carried on the engine. The terminal *P* is connected to the locomotive wheels while the terminal *N* is connected to one of the tender trucks, which is insulated from the rest of the train. These two terminals, therefore, rest on the track, in the relative positions shown in the diagram.

Suppose first that there is no train between stations *A* and *B*. The track relay *T* at *A* will be closed and the current will circulate as follows: From the station battery *S* at *B* through the top armature of the station relay *R* to *C*, through the rail to station *A*, through the relay *R* at that station and the top armature of relay *T;* forward through the line wire *L* to station *B*, through the lower armature of relay *T* at *B* and through the lower armature of relay *R* to *S*. In case there is a train in the block, as shown in the figure, the track relay *T* at *A* will open the circuit through relay *R* at that station. The engine approaches *B*, and as soon as the locomotive *P* passes the first insulated joint near *C*, the circuit through the engine forms a bridge over that joint. The result is that the current from *S* circulates through the circuit of the engine and back to the other pole of *S* instead of through the track and line wire. If the relay *R* be energized as shown at *B*, the current from *S* will flow in the direction to throw the polarized armature *D* of the magnet *M* in the

position to close the circuit through the white light in the engineer's cab. If the relay *R* is de-energized as shown at *A*, the circuit from *S* will pass through the magnet *M* in the opposite direction and close the circuit through the red lamp.

The indication thus received, when passing a station, will be carried to the next block station; thus, if the signals are thrown to danger upon passing the block station at *A*, the red light will continue until the station *B* is reached, where it will remain at danger or go to safety according to the conditions ahead. In case no indication either by red or white light is received in the engineer's cab, it is, of course, taken for granted that there is a danger signal and the engineer proceeds just as if a positive red-light danger signal had been received.

The object of the battery *H* is to guard against a break in the locomotive circuit. Under normal conditions the circuit from this battery divides, part going around by *F* and *G* and part by way of *N*, the rail and *P*. These two circuits neutralize each other in the magnet *M*, so that the polarized armature remains wherever it was placed at the last station passed. In case the circuit down through the track is broken, the current from *H* all goes through the top half of the magnet *M*, which is so wound that the armature closes the circuit through the red lamp. If the circuit through *F* and *G* is broken, the little relay *E* allows the lamp circuit to open and neither lamp burns. While the circuit from the battery *S* must go through the one cell at *H*, this cell does not interfere with the signal battery, merely working with it in one case and neutralizing a part of it in the other. It will be noticed that a train in any block reverses not only the battery of the first block station in its rear, but also that of the second station in the rear through the line wire. This gives an engineer a whole block in which to stop after he gets a red lamp, so that no other caution signal is required. The battery employed is of the Edison-Lalande type, two cells being used for a station battery and six for the lamp battery on the engine. The insulated joints at the front end of the short block are some feet apart, so that an unbroken circuit is maintained by one rail or the other between *P* and *N* after both trucks have passed the first insulated joints of the short block.

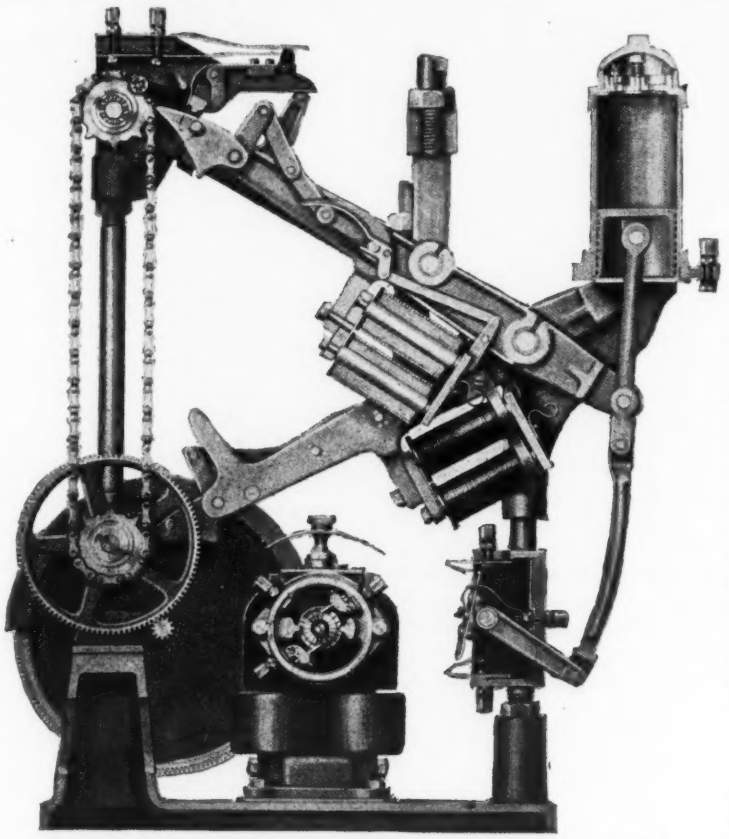


FIG. 12.—UNION ELECTRIC SEMAPHORE MECHANISM, SECTION.

TRACK CIRCUITS.

There are some special advantages in using the track circuits for signaling purposes. In case a rail breaks, the track circuit is broken and the signal at the entrance to that block goes to the stop position at once. All switches are wired so that when one is opened the track battery is short-circuited or opened at that point, which causes the signals to assume the stop position. As open switches and broken rails are the cause of many very bad accidents, these two features will be readily appreciated.

Track circuits work best when coarse gravel or broken stone is used as ballast and filled in no higher than one inch below the top of the ties. Rail bonds are usually made of common No. 8 galvanized telegraph wire. One way of fastening them is to wrap the ends around iron rivets and solder fast by dipping. The rivets are then driven tightly into quarter-inch holes drilled in the flange or web of the rails. Another way is to simply wedge the end of the wire into the hole with a channel pin. The bond wires are double, sometimes under the fish-plates and sometimes outside of them; sometimes on both sides of the rail and sometimes both on the inside, which is much better for inspection.

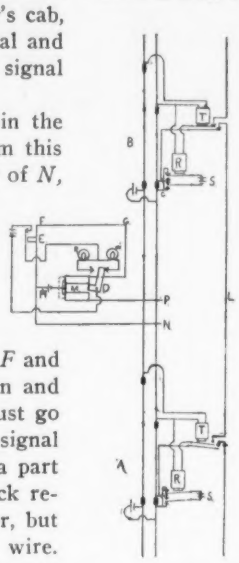


FIG. 14.—CIRCUITS OF MILLER SIGNAL SYSTEM.

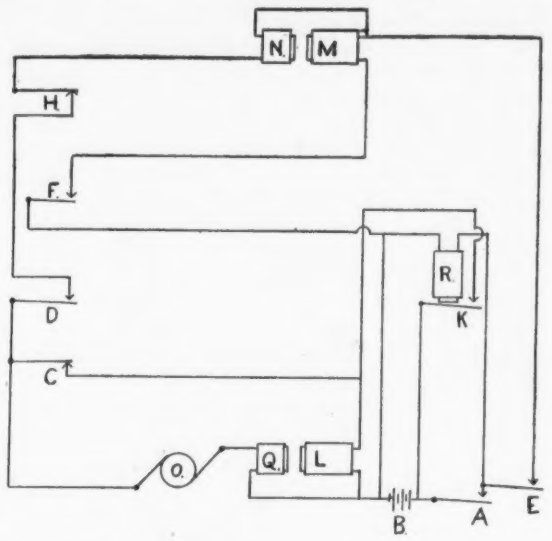


FIG. 13.—CIRCUITS OF UNION ELECTRIC SEMAPHORE MECHANISM.

The insulated joints are made by putting a piece of fibre about 3-8-inch thick and the shape of the cross-section of the rail between the ends of the rails. The fish-plates at these joints are made of wood, bound with iron, and the bolts insulated with fibre in such a way that no current can leak across.

COLOR OF LIGHTS.

In all semaphores and the disc signals described thus far, the night indications for "stop," "caution," and "clear," have been given by red, green and white lights respectively. Of late years many roads are doing away with white lights for such signals. If the signal lamp goes out, a false indication may be taken from a white light on the right of way in line with the signal mast. A broken semaphore glass can easily cause a white light to show when it should be red or green. A broken semaphore casting may do the same thing. A large number of roads are using green for clear, which leaves no color for caution or distant signals that is generally acceptable. Some roads are using yellow for caution and are satisfied with it, while others claim the yellow light is too much like the natural color of the kerosene flame, or when seen through smoke is too apt to be taken for a red light. The Chicago & Northwestern Railway system has used a combination of red and green for caution for 10 years with good satisfaction.

The Union Pacific Railroad adopted this combination in the fall of 1901, as well as green for clear in switch lamps, semaphores and all other places where white had been used for clear. The combination of red and green lights is given by a single lamp. The front of the lamp shows red in the usual manner. At one side of the flame is a plain reflector placed at an angle of 45° with a red glass. In front of this reflector and in line with the red glass is a green glass. In this manner the one flame gives the appearance of a red and green light side by side, which indicates caution. An opaque disc is moved before the red glass to give a clear (green) indication.

BATTERIES.

The battery used on track circuits is usually the common gravity battery such as is used in telegraphy. The battery for each block

is usually 2 or 3 cells in parallel, located in a well deep enough to be away from frost. For signal batteries, the Pennsylvania Company uses two sets of lead storage cells charged by a 500-volt generator in a shop about 20 miles from the farthest battery. There are six cells in each set giving about 12 volts. They are changed every day, one set being charged while the other is in use. These batteries are kept in wells made of boiler iron lined with wood. They are about 7 feet deep and are sunk in the ground nearly to the top. A double cover keeps out the frost. The track battery is also kept in these wells. On the Pan-Handle, this same type of signal battery is charged from 18 cells of gravity battery. The Union Pacific Railroad uses 10 cells of gravity battery on its normal danger enclosed disc signals. The Union Switch & Signal Company for operating its electric semaphores uses 16 cells of Edison-Lalande battery giving about 12 volts. This battery has the great advantage that no well is needed. It is placed in the base in the semaphore post just below the mechanism and will work well at a temperature of 20° below zero.

TRACK RELAYS.

The principle of the track relay is very simple, yet this instrument is the most vital part of the signal apparatus. So delicate is the adjustment required that it is deemed advisable to have none but authorized skilled hands attempt it. One company seals up its relay case so that it cannot be opened to change the adjustment without detection. Fig. 15 shows a sectional view of such a relay made by

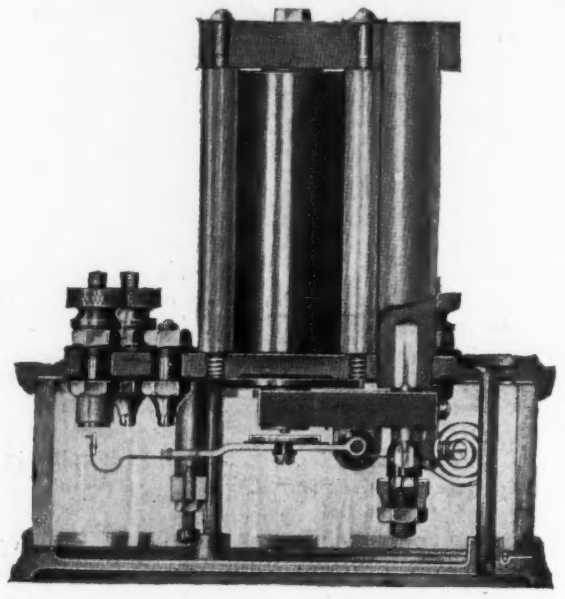


FIG. 15.—UNION TRACK RELAY.

the Union Switch & Signal Company, with a glass case protecting the armature and the contact points. The coils are wound to about 4 ohms resistance. The contact points are usually double, so that two independent circuits may be controlled by them.

There are approximately 27,000 miles of track or a little over ¼ of the total mileage of this country protected by block signals. Only about 10 per cent. of this mileage, however, has automatic signals.

The above is an abstract of a thesis presented by the writer for graduation at the University of Nebraska, June, 1902.

Geissler Tube and Condenser Effects.

BY ALFRED G. DELL.

In the following I will give some of the causes of the effects, as they appear to me, described in communications of mine to ELECTRICAL WORLD AND ENGINEER of Jan. 25 and March 29, 1902. In the first place I will note that the Geissler tube is one of the most sensitive things used in experimenting. When the Geissler tube is connected in the secondary of an induction coil, the anode and cathode discharges through it are plainly shown. There are no reversals, whether there is a condenser across the break of the primary or not, and, as published some years ago, it is impossible to tell from the tube when the condenser across the break of the primary is connected or disconnected, the light appearing with equal intensity. The tube allows an easy discharge through it, and does not offer much resistance. It is nearly independent of the spark length obtained by the condenser across the break, a long spark not being required to discharge through it. Hence, the energy between a break and the next make of the battery is the same whether the condenser or not is used, which has a considerable bearing on the action of a coil. Some may say a Geissler tube in series with a Crookes tube shows both bulbs filled with light, and would indicate reversals. This is not so, however. When the impulse on the side of the Crookes tube containing the Geissler rushes through the Geissler, it meets immediately the resistance of the high vacuum of the Crookes, and not being able at once to discharge through the tube rushes back into the Geissler, and is held on the electrode in the Crookes, and also in the Geissler vacuum for a brief moment. Of course, all occurs in an incredibly short time, and the eyes see the effects all together.

Those persons who think there are reversals in the primary of an induction coil from the condenser across break of primary will certainly be brought to a halt by the Geissler tube, for if there were any reversals in the primary there would also naturally be reversals in the secondary of the coil, and the tube would to a certainty show them, although they might be the lightest superimposed impulses imaginable—of course, providing the tube is a sensitive one.

In the experiment of Jan. 25, 1902, I stated that when I placed a small piece of mica, with tin-foil glued on both sides and covered with wax, one side of which was earthed and the other connected to the one side of a spark-gap in the secondary of an induction coil (there being, of course, a condenser across the break of the primary of the coil, so I would have a good spark in the secondary), there were superinduced high-potential discharges from the secondary into the primary, which were shown by a Geissler tube placed across the battery poles or elsewhere. The cause of such an action is very plain to my mind. When the one side discharge rushes into the condenser before the spark is made, it rushes out again, but all does not go to the spark-gap; some little rushes around the secondary of the coil, and thus produces the induction into the primary, the spark-gap in air offering a high resistance.

In the experiment described March 29, 1902, where a rotating disk is used and the condenser is shifted from one side of the spark-gap to the other, the explanation is not so easy; in fact, I have failed to explain it fully. It would appear that an explanation would require a thorough knowledge of the difference between + and — discharges of the secondary of a coil, and if that was understood the knowledge of any electric current would be plain and not a matter of guess work. I will attempt to give one of my explanations and also state where it fails. When the condenser is on the — side, the direction of starting rotation is not changed, the disk still starts from + to — from rest, and will rotate from — to + when started in that direction. Both velocities are very much increased over the ones obtained without the condenser. When the + electrode is touched, the disk only rotates one way, from — to +, with a slow constant velocity and a stiff resistance to any change. If it is rotaing rapidly from + to — and the + side is touched, it gradually slows up, reverses and rotates until, as stated, it reaches the slow velocity.

Now, if the condenser is on the — side, that part first rushes into the condenser, and out again to meet the discharge from the opposite side, a small part going back through the secondary of the coil. The side containing the condenser, that is the — side, presents that part of the impulse shortened through condensation, and to meet the — discharge the + is lengthened. Both sides make their discharges in shorter times than otherwise, on account of the delay; hence there would be an increase of velocity, but the disk would still rotate both ways. Up to this point the theory seems all right.

When the condenser is touched to the + electrode, that part of the discharge would be shortened, and the same thing as the above should occur. The + side being the stronger, it would more nearly equalize the two forces, at least reduce the +; but the disk rotates only from — to +, where it should also rotate from + to —, if started in that direction, if it did not rotate from rest from + to —. Hence, you can see that it is entirely in the difference of the two forces. What that difference is I do not know, and the person who can tell will surely know more about electricity than is known, and should understand the very life of it. As explained in the experiments published, a ground acts like a condenser. When the condenser or ground is used, as described above, the spark in the

secondary of the coil is slightly harder to maintain than when not used.

When the ground connection is used instead of the condenser, it acts as a condenser; the reason appears to be that the spark is made too quick for the charge to be dissipated through the ground; it rushes back to the spark-gap before it can be scattered in the earth, although I think there is some little more dissipation with the earthed connection than with the condenser. The ground connection to the one side of the condenser dissipates that induced charge entirely; it does not return, as there is no inducement for it to do so.

Electrical Mining Equipment on the Comstock Lode.

BY LEON M. HALL.

WHEN the mining properties on the Comstock Lode were developed, operations were carried on by means of steam power, wood being used as the fuel. This was very costly on account of the scarcity of wood. The milling was, until quite recently, done at a distance of some 15 miles from the mine, at a point on the Carson River, where cheap water power could be obtained. About two years ago the question of electrical transmission for the purpose of supplying power for deep mining operations on the Comstock Lode was taken up, and since then extensive hydraulic developments have been carried out at Floriston, Cal., on the Truckee River. Power is now transmitted 35 miles to the mines in Stotey County, and a dozen or more of the properties have been equipped with electrical machinery. Among these is the C. & C. shaft, of the Consolidated California and Virginia Mining Company, which has a world-wide reputation as a bullion producer.

The power plant on the Truckee River is about two miles east of Floriston. The river is dammed just below the Floriston Pulp and Paper Mill, and the water is conveyed about 600 feet through a canal, and then 8,600 feet through a wooden flume 6 feet 8 inches high and 10 feet wide, to a point directly above the generating station. It is then conducted through two wooden stave pipes, 160 feet long and 6 feet in diameter, to the wheels, upon which there is a head of 84½ feet. There are two pairs of 27-inch horizontal McCormick turbines, direct connected to Westinghouse, three-phase, 60-cycle generators of the revolving armature type. These generators are separately excited by two 22½-kw direct-current machines. (Fig. 1.) The wheels will each develop 1,400 hp at 400 r. p. m., with the above head of water. They are regulated by two Lombard governors. Current is generated at 500 volts, and is raised to 24,000 volts by means of six 300-kw Westinghouse, oil-insulated transformers, at which potential it is transmitted 33 miles over a double circuit of No. 4 hard-drawn copper wire, to the sub-station at Virginia City. The line is composed of square redwood poles, 30 feet in length, with pine cross-arms and locust pins, upon which are mounted 7½-inch Locke insulators. The telephone circuit is carried on the same poles by oak brackets with pony insulators. At the sub-station at Virginia City (Fig. 2) the potential is lowered to 2,300 volts by means of six 450-kw Westinghouse, oil-insulated transformers, and at this potential current is distributed to the various mining companies. The distribution circuits are composed of weather-proof wire, and are designed for 4 per cent. drop under full load. The generating station at Floriston is constructed of brick with a galvanized iron roof, and the sub-station at Virginia City is entirely covered with corrugated galvanized iron.

The plant has been in continuous operation since Oct. 20, 1900. The Truckee River General Electric Company sells power to the various mining companies at $7 per horse-power per month, the amount used being based on a maximum peak load of two minutes duration. This, with other conditions, has made necessary the installation of machinery of the most durable character and the introduction of some features which are rather unique in character. In the C. & C. Shaft at Virginia City every precaution has been taken to secure thorough reliability and the highest efficiency. The electrical machinery in operation on the surface consists as follows, all being Westinghouse: A 200-hp, 2,200-volt, variable-speed, three-phase, induction motor, geared to balanced electric hoist; a 100-hp, 2,200-volt, induction motor, belted to a 16½-inch x 30 inch single-stage air compressor; a 30-hp, 440-volt induction motor, operating circular saws; a 15-hp motor, driving tools in the machine shop; a 10-hp motor, operating a Blake rock breaker at the ore bin; three 15-kw indoor transformers, transforming from 2,200 volts to 440 volts; one 5-kw lighting transformer, transforming from 2,200 volts to 110 volts; two Manhattan arc lamps; fifty incandescent lamps, together with necessary lightning arresters, fuse blocks, cut-outs and switches. The apparatus underground consists of the following: A 15-hp induction motor, operating at 440 volts, and driving a fan on the 250-foot level; two 10-hp motors, driving fans on the

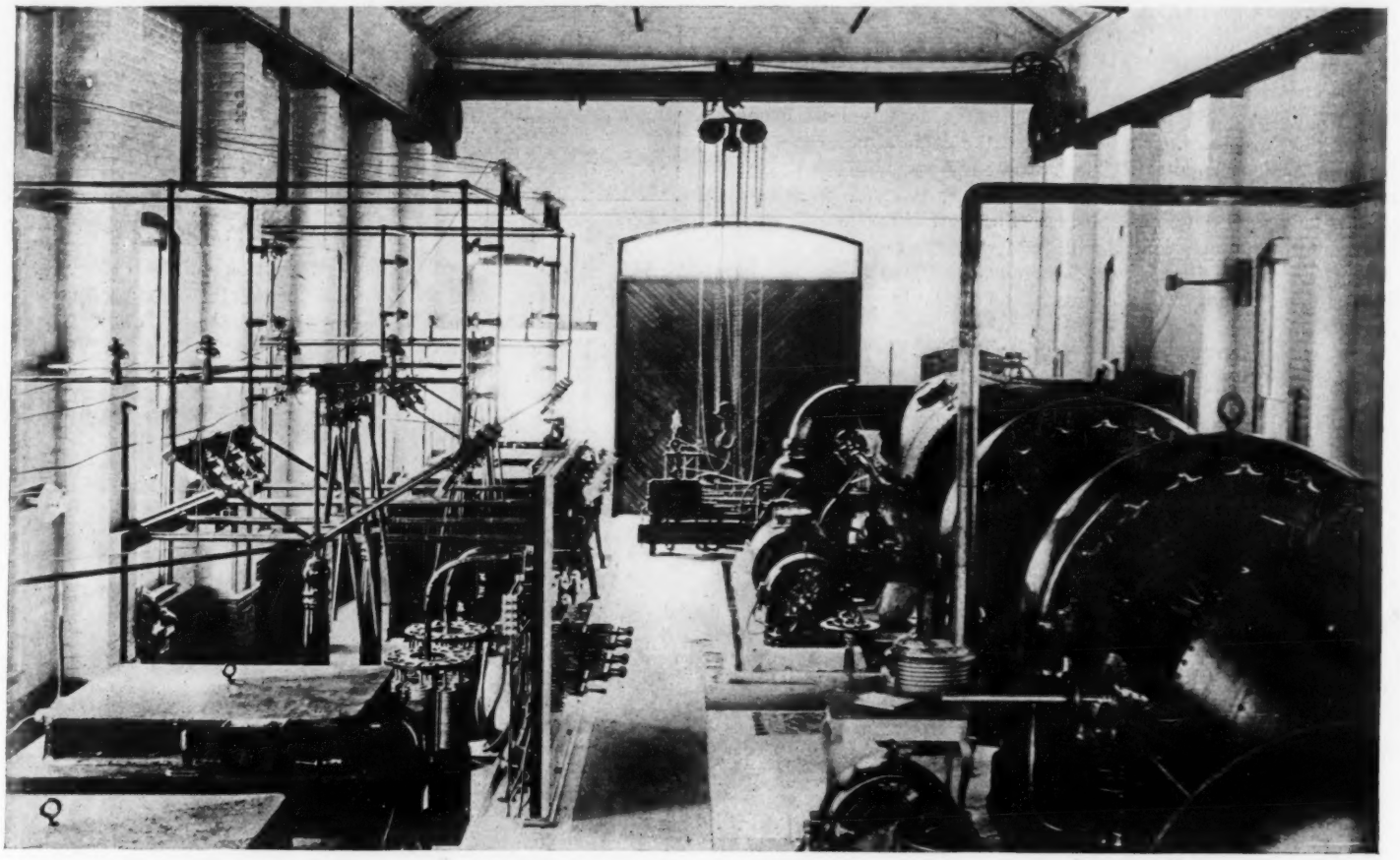


FIG. 1.—GENERATING PLANT, FLORISTON.

1,750-foot and 2,150-foot levels (Figs. 8, 9 and 10); three 225-hp motors, operating at 2,200 volts, and geared to three duplex double-acting Riedler pumps located on the 2,150-foot level; three 10-kw transformers, transforming from 2,200 to 440 volts, located on the 1,750-foot level; a 3-kw lighting transformer, transforming from 2,200 volts to 110 volts, on the same level; three 15-kw transformers, transforming to 440 volts on the 1,950-foot level; two 5-kw lighting transformers, transforming from 2,200 volts to 110 volts, on the same level; three 10-kw transformers, transforming to 440 volts, on the same level; a 5-kw lighting transformer, transforming to 110 volts, on the same level. These are all Westinghouse transformers, and supply the motor and lighting circuits within the mine.

There are 250 16-cp incandescent lamps scattered through the workings underground. A No. 6 B. & S. three-conductor, lead-covered cable, armored with iron wire, extends from the surface to the 2,150-foot level, and a No. 3, three-conductor cable to the pumps on the same level. The weight of the No. 6 cable is 6 tons, and of the No. 0 cable 10 tons. The cables were lowered down the wall by means of the hoisting rope, and then securely clamped to the wall plates. At each station a water-tight junction box is used, and the lead covering sweated into a tight-fitting sleeve located in the side of the box.

The power is brought into the works over two separate circuits, each of which is provided with a single-pole switch at the entrance of the building, and also an integrating wattmeter with its transformer. The pump circuit is further equipped with an ammeter, a frequency indicator, a power-factor indicator and a static ground detector. Oil-break switches are used on the cable circuits and upon all of the 2,200-volt motors. The smaller motors, both on the surface and underground, are equipped with auto-starters, quick-break switches and slate-base fuse blocks. Some of these machines are located in warm places and operate under severe conditions.

The entire installation is wired with lead-covered cables or with rubber-covered copper wire, mounted on glass insulators or porcelain knobs. The greatest care is used in installing the wiring, with the result that it is safe and gives absolutely no trouble. Candles have been entirely discarded, incandescent circuits having been carried directly to the working faces and into the slopes. The current is taken into the mine at a potential of 2,200 volts, through the cables above mentioned, and the potential is lowered in the mine by transformers, which are located as near as possible to the point of consumption.

The compressed air plant, supplying air for drilling, a number of underground hoists and the hydraulic pump, consists of a 16½-inch x 30-inch Rand & Waring single-stage air compressor, driven at 73 r. p. m. by a 100-hp motor. The motor speed is 580 r. p. m., which is reduced by a countershaft with wooden rim pulleys and rubber belting. No automatic regulator is used at the present time, as the compressor is working to its full capacity, and the motor is developing 96 hp.

The electric hoist (Figs. 5, 6 and 7) is a decided departure from usual practice in deep mine hoisting plants, and embodies what is commonly known as the balanced, continuous or tail-rope system. This was adopted in order to reduce the cost of operation, and also the size of the motor to the lowest size compatible with the duty required—viz.: to hoist 500 tons daily from the 2,500-foot level by means of double-deck cages carrying 3,600 pounds of rock. The hoist consists essentially of a main driving drum and an idler, around which is wrapped a 1⅛-inch plow-steel wire rope. The rope passes down one compartment, around a movable tail sheave and up the other. One cage is inserted between the ends of the rope and the other fastened to it by means of heavy iron clamps. The main driving drum is geared to a 200-hp variable-speed, three-phase induction motor, which operates at a maximum speed of 580 r. p. m., moving the cages through the shaft at 1,250 feet per minute. The speed of the motor is readily controlled by means of variable resistances inserted in the secondary winding, but external to the motor itself. The variation of the resistance is accomplished by the use of a special controller resembling an ordinary street car con-

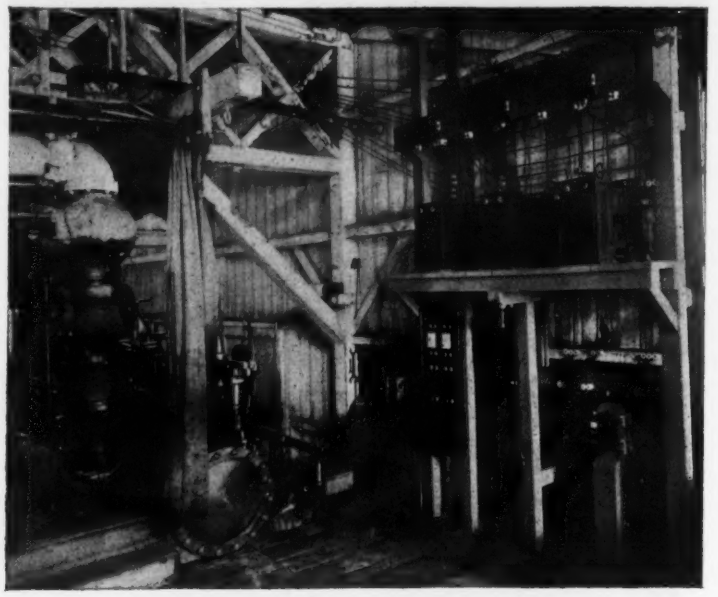


FIG. 3.—THE 2,150-FOOT LEVEL STATION.

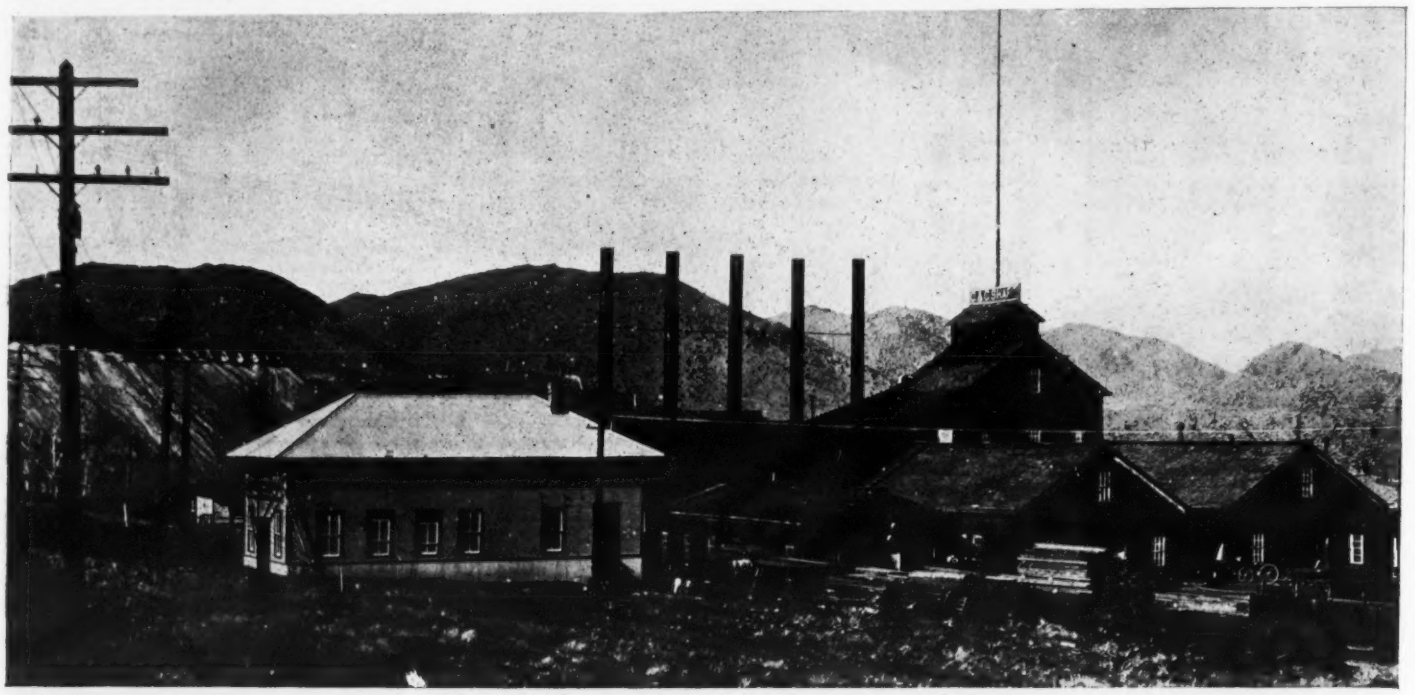


FIG. 2.—TRUCKEE RIVER SUB-STATION.

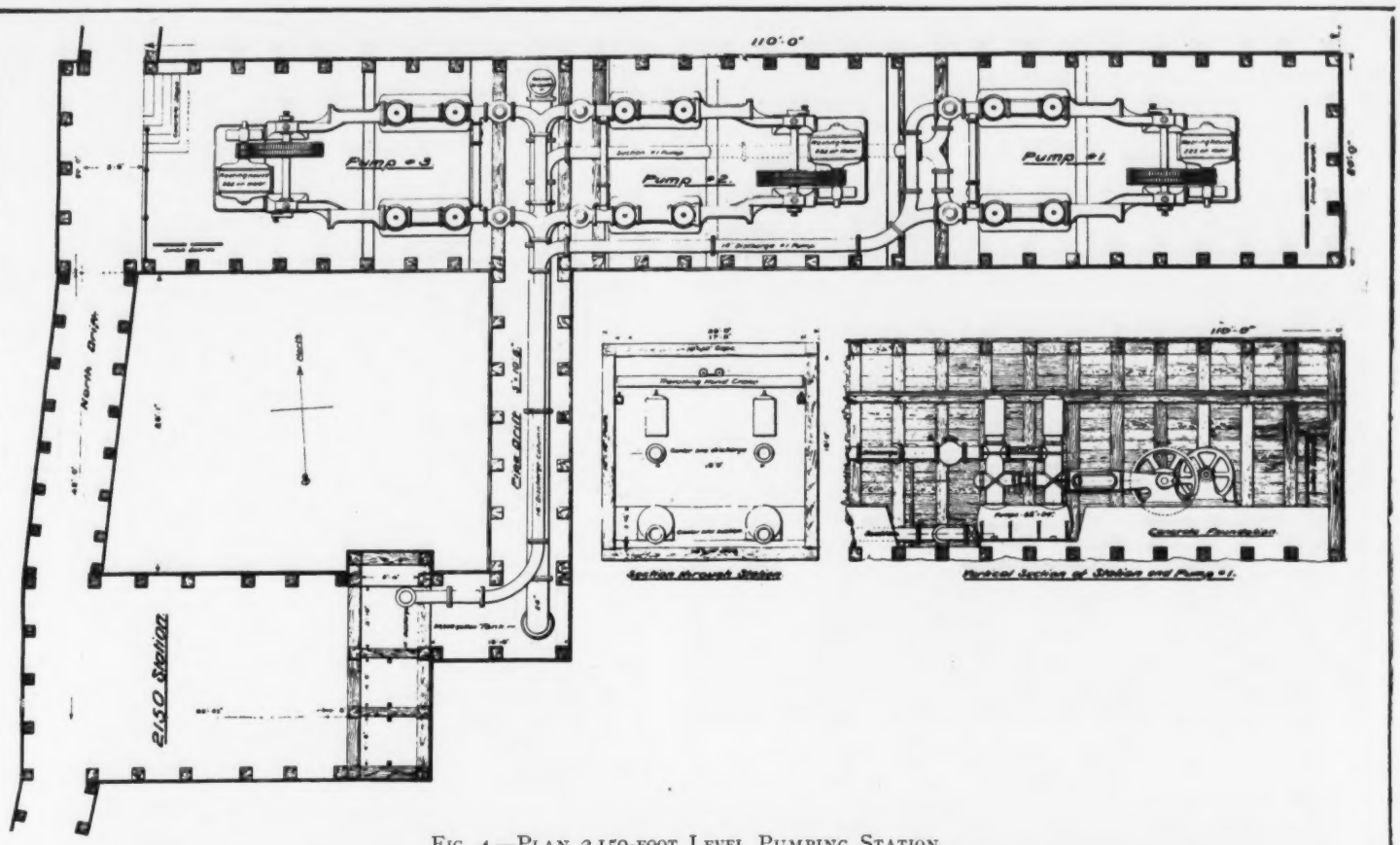


FIG. 4.—PLAN 2,150-FOOT LEVEL PUMPING STATION.

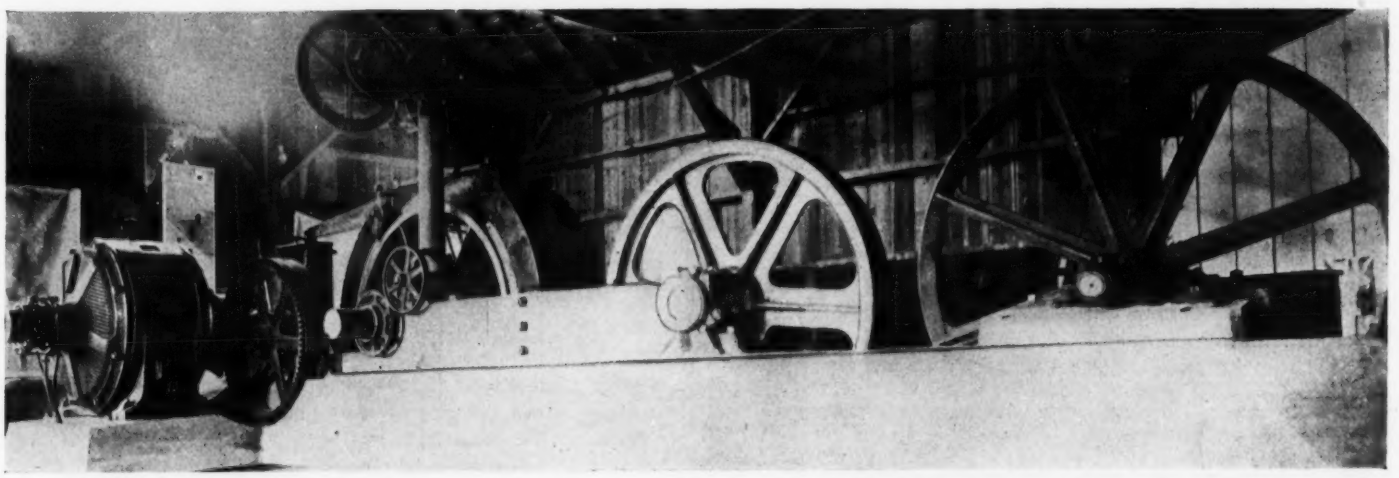


FIG. 5.—200-HP MOTOR AND CONTINUOUS ROPE HOIST.

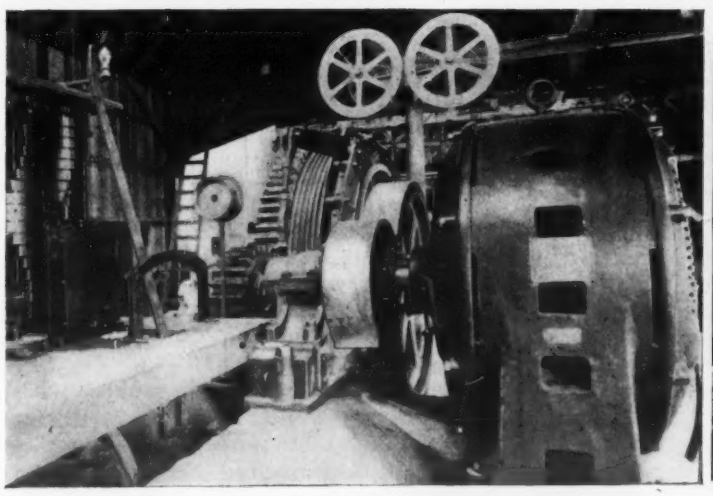


FIG. 6.—CONTROLLER SIDE OF ROPE HOIST.

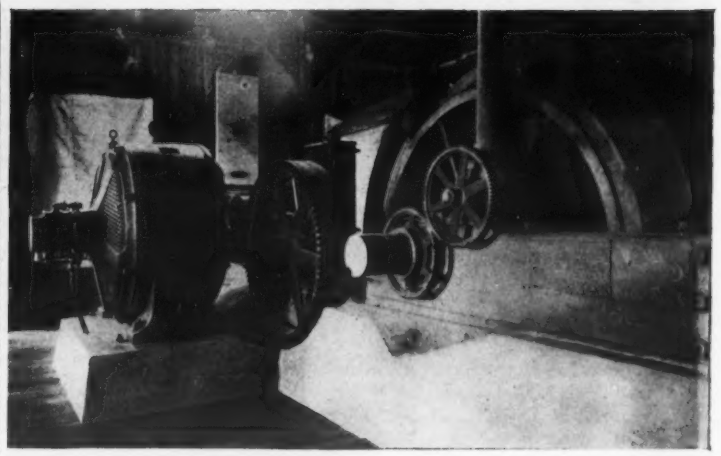


FIG. 7.—HOIST DRIVEN BY 200-HP MOTOR.

ELECTRICAL MINING EQUIPMENT ON THE COMSTOCK LODE.

troller; the primary circuit is controlled by means of an oil-break switch. The hoist is equipped with heavy post brakes, hydraulically operated, and the machine is handled with remarkable ease. In tests that have been made these hoists show a net efficiency of about 75 per cent., counting all electrical and frictional losses.

The pumping plant (Fig. 11) consists of three duplex, double-acting 6 11-16 x 24-inch Riedler pumping engines, located on the 2,150-foot level (Fig. 3). These pumps take their water supply from a tank on the east side of the shaft just below the 2,150-foot station. Each pump is separately driven by a 220-hp, 2,200-volt Westinghouse induction motor, and has a capacity, at 110 r. p. m., of 1,500 gallons per minute to the height of 450 feet, or to the Sutro Tunnel level. The motors run at a speed of 495 r. p. m., the necessary reduction being obtained by the use of cut gearing with stepped teeth. The total capacity is 4,500 gallons per minute, and is intended to take the water from the hydraulic elevator as long as it is used as a sinking pump.

FIG. 8.—MOTOR-DRIVING BLOWER AT 1,750-FOOT LEVEL.

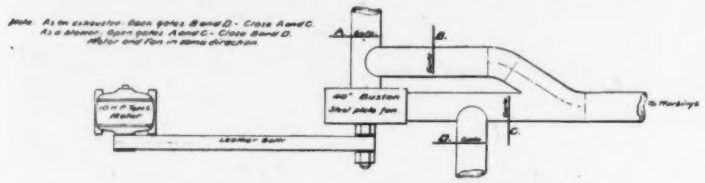


FIG. 10.—DIAGRAM OF 40-INCH REVERSIBLE FAN.

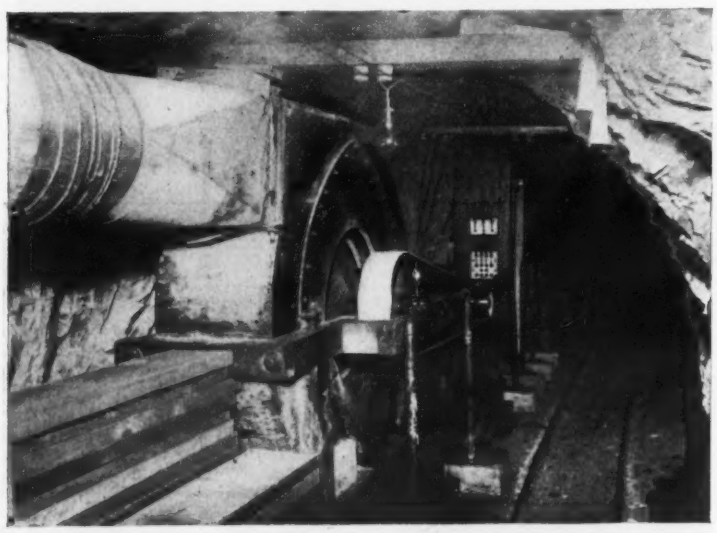


FIG. 9.—MOTOR-DRIVING BLOWER AT 2,150-FOOT LEVEL.

The pumps are located in a station 30 feet north of the shaft. This station is cut from the solid rock and is 18 feet x 17 feet 8 inches in section and 110 feet long. It is timbered with 14-inch x 14-inch pine timbers, with 3-inch planking. A drift, 5 feet x 10 feet 6 inches in section, connects it with the shaft, and ventilation is obtained by means of a small electrically-driven blower. The motors are all wired with lead-covered cable, and the station is lighted with incandescent lamps. A 10-ton hand crane travels the entire length of the station, so that the labor of handling and installing machinery has been reduced to a minimum.

This plant is undoubtedly one of the best and most complete mining installations in the world, and its operation has been entirely satisfactory, both in regard to economy and to reliability. Up to the time when electrically transmitted power was adopted, the cost of motive power was never less than $20 per horse-power per month, while under existing conditions, it is reduced to $7. For example, the cost of operating the 100-hp air compressor usually averaged about $1,800 per month, while to-day it is only $672. The entire plant was installed according to my plans and specifications, and under the able direction of Supt. Jos. R. Ryan. It has proved an unqualified success from the very beginning.

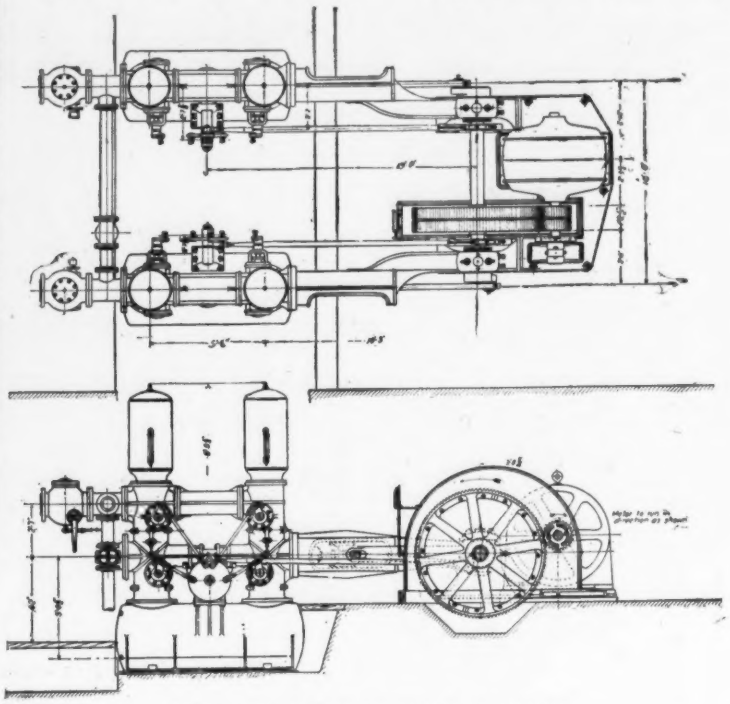


FIG. 11.—DIAGRAM OF PUMPING ENGINE.

Expenditure on Tramways in London.

After a prolonged discussion the London County Council passed, on July 29, all but one of the comprehensive schemes for the extension of the municipal tramways. The total length of the new tramways proposed was 26¼ miles at an estimated cost of £1,180,750. There will be an additional charge to the tramways account of £127,-165 in respect of the street widenings, and one-third will be charged to the local authorities. The new lines range all over London, being extensions and linkings-up of existing systems. The opposition to the proposals was led by Mr. Beachcroft, who estimated the total cost of all the tramway undertakings at £12,000,000. They ought to satisfy themselves that they were entering upon a profitable undertaking. The conduit system which was proposed would cost from £8,000 to £10,000 a mile more than the overhead.

Mr. Benn and Mr. Allen Baker replied, the latter arguing that the new lines would earn £146,000 and leave a profit of 8 or 10 per cent.

The London County Council experimental conduit tramway from Westminster to Tooting is steadily, as it progresses, bearing out the forecasts made about its high cost. In February, 1901, the council gave its sanction to estimates amounting to the total of £623,500 for the conversion of this line to electricity, and the provision of machinery, rolling-stock and generating plant. This was very much in excess of the highest amount that an overhead system would have cost, but the council was prepared to spend more to avoid street wires.

This expenditure of £623,500 has been raised till it now amounts to no less than £981,497. The road work is to cost £12,000 more than was estimated; the power station, estimated at £100,000, is to cost £236,000; extra concrete on the roadways comes to £19,921 more; besides the extra on the power station there is a further addition of £64,600 for plant and sub-stations not at first provided for; and a car-shed will be wanted at Clapham, at a cost of £85,000.

The Fessenden Wireless Telegraph Patents.

BY A. FREDERICK COLLINS.

IN this day of "wireless," when a new coherer or a modified form of induction coil constitutes a "system," it is refreshing to note and review the work of Prof. Reginald A. Fessenden, who, in a most exhaustive and classical series of patents, describes in lucid and simple language, the comprehensive work he has done.

In this magnificent collection of data, dealing sometimes in broad generalizations, sometimes in minute detail, as the requirements of the case may be, Prof. Fessenden has shown himself a pastmaster in the theoretical and practical science of wireless telegraphy, and has not only evolved apparatus entirely different from that of his contemporaneous workers abroad, but has discovered new phenomena separate and distinct from those of Hertz, who gave to the world a physical demonstration of electromagnetic waves. The waves of Fessenden differ from those of Hertz "in that they are not complete waves, but only half-waves, and in that they travel over the surface of a conductor, and, hence, *unlike* Hertz waves. can be deflected from a straight line."

These Fessenden waves are described as "semi-free ether waves," and are yet different from those investigated by Lodge in metal conductors, in that they are not current waves. The portion of the Fessenden specification embodied in Patent No. 706,746, relating to electromagnetic waves, is of such notable interest, I take the liberty to reproduce a portion of it intact, as follows: "In the Lodge waves the electric energy is maximum when the magnetic energy is minimum, and all energy not absorbed by resistance losses is recoverable, while with the form investigated by me (Fessenden) the electric energy is a maximum at the same time as the magnetic, and none of the energy radiated is recoverable except by deflection. I have found that it is essential for the proper sending and receipt of these waves that the surface over which they are to travel should be highly conducting, more especially in the neighborhood of the point where the waves are generated. I have found that this highly-conducting portion of the surface should extend to at least a distance from the origin equal to $\frac{\lambda}{4}$ of the wave in air, and in the direction toward the station to which it is desired to send the waves."

The arrangement shown in Fig. 1 is the physical method by which this is accomplished, and is, in Fessenden's terminology, a *wave-chute*.

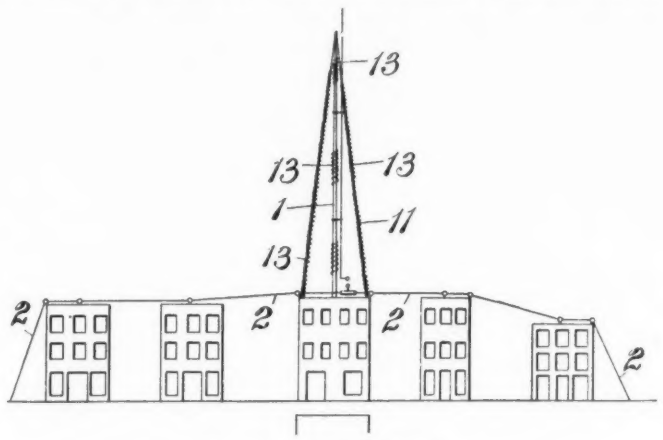


FIG. 1.—"WAVE-CHUTE."

Briefly, 1 is the antenna or sending conductor, and 2 2′ 2″ is the grounded conductor leading across buildings and other obstacles to a $\frac{\lambda}{4}$ or more, beyond the limits of obstructions, when the terminals are earthed, as shown. The coils, 3 and 4, forming guys from the mast, have a natural period of oscillation, different from that of the sending conductor, and this, with the grounded conductor or wave-chute, eliminates outside interference of wave lengths not in tune, and dissipates atmospheric potentials which ordinarily produce untoward effects in the reception of wireless messages.

Another novel feature of the antenna and oscillator system is due to the discovery of Fessenden—that if electromagnetic waves were produced in a medium having a specific inductive capacity and permeability to electromagnetic waves greater than air, the height of the antenna may be considerably reduced, since "the periodicity of oscillation is decreased compared with that of the same antenna in air; and the radiation is, therefore, increased, giving the effect of a long conductor." The arrangement to accomplish this is quite simple. The antenna or conductor with the oscillator is placed within a second and tubular conductor, and this, in turn, is immersed in water or other liquid having an electric constant greater than that of air, and on which the emitted wave length depends.

In practice, Fessenden employs at the sending station a vertical wire, having a large capacity and low induction. The former can

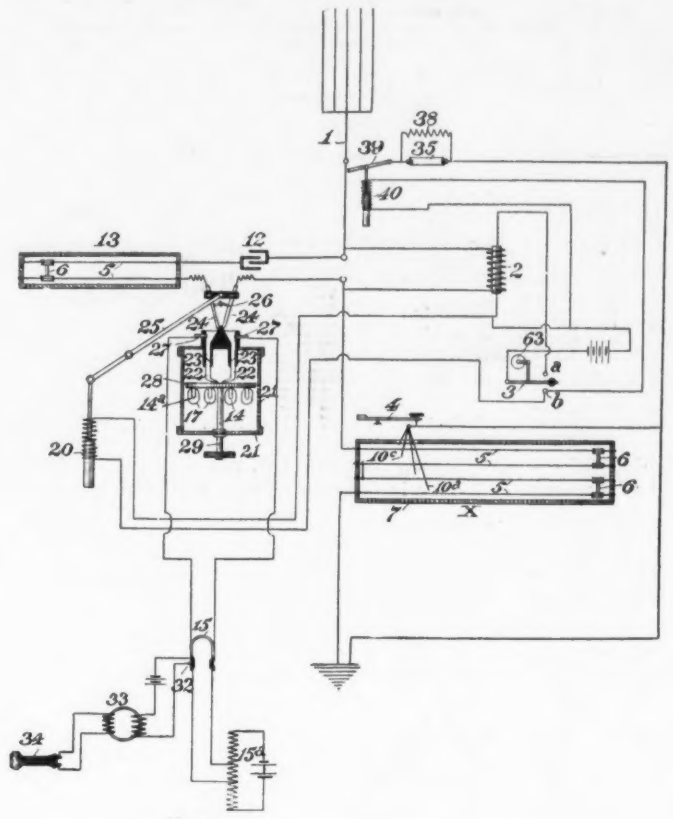


FIG. 2.—DIAGRAM OF SENDING AND RECEIVING APPARATUS.

be regulated by increasing the area of the antenna, and the latter by adding to the number of turns of wire connecting the vertical wire with the source of electromagnetic force.

One of the strongest points in Fessenden's apparatus is that by which he is enabled to send messages at an exceedingly high rate of speed—much higher than in the ordinary method of making and breaking the primary circuit; he has also found it possible to send signals over a much greater distance with a smaller expenditure of power than in any of the present systems. Again, a third factor is the absolute accuracy and certainty with which the receiver operates, enabling the code-messages and other difficult matter to be transmitted by wireless equally as well as by wire, and without fear of error.

The complete sending and receiving apparatus for accomplishing these extraordinary results is shown in Fig. 2. In the specification of his patent No. 706,742, Fessenden says: "In the practice of my invention I employ at each station a conductor, 1, connected to one of the terminals of the induction coil, 2, the other terminal being grounded. A switch, 3, is arranged in the controlling-circuit of the generator (induction coil) so as to permit of the generator being rendered inoperative when the apparatus is employed as a receiver. When sending, it is preferred that the generator should be kept continuously in action. When the generator is in continuous operation a key, 4, is employed by throwing the antenna out of tune. with the station to which signals are being sent. This is effected, not by making and breaking, but by short-circuiting, more or less, the tuning device, which is arranged in series with the conductor, 1, and preferably between the generator and the ground."

The tuning is accomplished by means of one or more pairs of parallel wires or strips, 5, forming a tuning grid, and one or more movable contacts, 6, forming an electrical connection with the wires of each pair. These wires are arranged in a box, 7, containing sufficient oil to cover the wires to a depth of an inch or so. This construction permits of proportioning the capacity and inductance so as to obtain a pure sine wave in order to give good resonance. To obtain

pure sine waves the ratio of capacity to inductance per unit length should be the same as nearly as possible for all portions of the conductor. In this respect Fessenden's system differs sharply from those involving the use of coils suited to attain the greatest inductance with a given amount of resistance.

In Fig. 2, the key represents an ordinary make and break device, but Fessenden prefers to operate the induction coil continuously, and

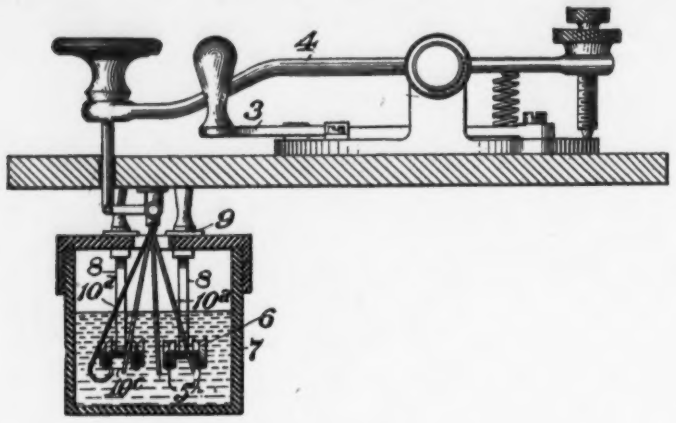
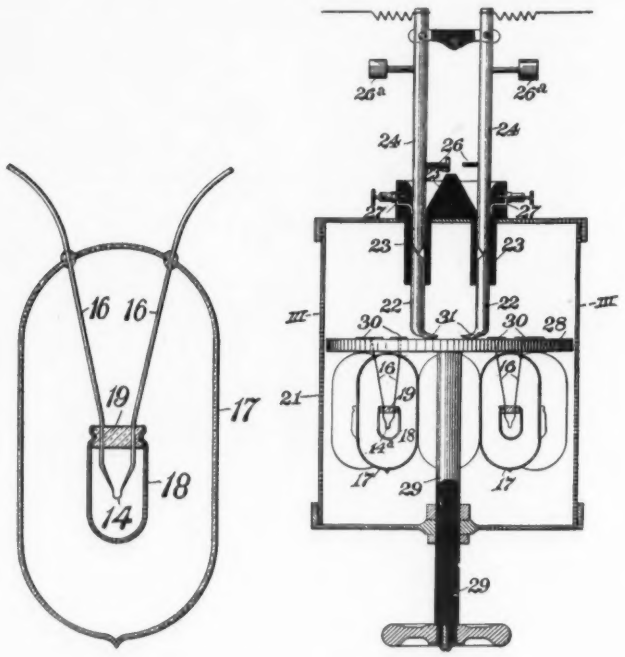


FIG. 3.—TRANSMITTING KEY.

by throwing the sending circuit out of tune, waves of a desired length only will be emitted. This is done by means of the key 4, shown in detail in Fig. 3; it is provided with a finger, 10, arranged to be pressed into contact with one of the wires, 5, by a movement of the key 4, which is connected with the ground, so that when the finger is in contact with one of the wires a shunt circuit is joined around a portion of the tuning-gird.

The receiving circuit consists essentially of the conductor 1 (Fig. 2), condenser, 12, a combined capacity and inductance forming a tuning-gird, 13; these are connected in series, but the condenser, 12, and the combined inductances and capacity, 13, are in shunt to the spark-gap, thus bringing them in parallel with the sending conductor.

In order to obtain speed, Fessenden has eliminated the cumbersome Morse registering device, and substituted the telephone receiver.



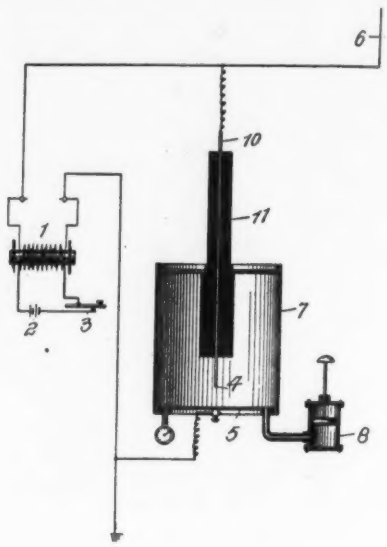
FIGS. 4 AND 5.—WAVE DETECTORS.

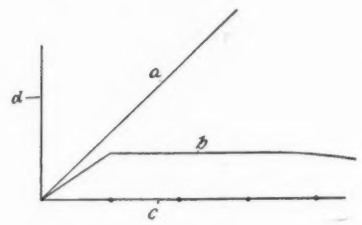
This necessitates some form of a wave detector that is more rapid than the process of cohesion and decohesion. The Fessenden wave-detector is far more rapid in operation than a self-restoring coherer, and has the added advantage of utilizing all the energy of the wave, whereas in ordinary coherers only that portion is used which is necessary to bring the potential to a certain critical value when cohesion takes place.

The Fessenden detector is shown in detail in Fig. 4, and its relation to the receiving circuits in Fig. 2.

This device is based somewhat on the principle of a bolometer, but instead of having a large radiating or absorbing surface in proportion to its mass, the Fessenden detector is just the reverse; so that the conductor losses will exceed the radiation losses; the heat capacity is exceedingly small, so that an infinitesimal amount of energy is required to heat it. To obtain these effects in practice, a short loop of silver wire, 14, having a diameter of .002 inch, and having a platinum core .00006 inch in diameter is fastened to the leading-in wires, 16, which are sealed in the glass bulb, 17. The tip of the loop is immersed in nitric acid and the silver dissolved away, leaving the platinum exposed. To further decrease the loss of radiation by heat, the loop is enclosed in a silver shell, 18, as shown. The bulb may be exhausted to further increase the sensitiveness of the detector.

The device numbered 21 to 29, and shown in detail in Fig. 5, is a holder, arranged to contain a number of wave detectors just described. It consists of a movable disc, 28, of hard rubber, upon which a number of the detectors are arranged, and any one of which may be brought into contact with the rods or leads, 23 and 24, and in case any one of the detectors becomes inoperative a fresh detector may be instantly substituted. The disc, 28, is supported by the rod 27;





FIGS. 6 AND 7.—FESSENDEN APPARATUS AND DISCHARGE CURVES.

the whole receiving mechanism is then placed in the metal case, 21, which offers additional protection to it. 20 and 25 represent an electromagnetic cut-out, which becomes operative through the switch *a b* 3 (Fig. 2), the lever, 25, drawing the leading-in wires, 24, in or out of contact as the case may be. A double receiver-head telephone, 15, is connected in series with a pair of cables, 15a, having a slightly different e. m. f.

The call-receiving apparatus is shown in 32, 33 and 34 (Fig. 2), where 32 is a coherer, 33 a transformer, and 34 a telephone bell or other suitable indicating mechanism. To protect the apparatus from the untoward effects of atmospheric electricity, a coherer, 35, connects the antenna with the ground.

Instead of the wave detector shown, an earlier form employed by Prof. Fessenden prior to his leaving Allegheny, may be substituted. It consists essentially of a silver ring resting on two knife edges of silver and a third edge of carbon. This forms a microphonic contact, and acts as a translator of electromagnetic waves into readable Morse. It is also the subject matter of a patent.

Another clever device is illustrated in Fig. 6, the object of which is to maintain a certain definite relation between the inductance, capacity and resistance, regardless of the potential employed. The disruptive discharge takes place in air under pressure, the spark-gap being

formed between the part 4 and the plate 5. "In using this apparatus, the terminals are adjusted to about one-quarter of an inch apart when using a 12-inch coil. By increasing the pressure the dielectric strength of the medium is increased, and the spark-potential can be raised to almost any amount without any material loss in oscillatory power, as indicated by the line *a*, (Fig. 7), whereas in air under ordinary pressure it is found that no matter how high the potential is raised, practically no increase in efficiency is obtained higher than given with a spark length, as indicated by the line *G*. The horizontal line *c* indicates spark potential in inches, and the vertical line, *d*, represents the radiation."

In all, there are 13 patents in the recent issue to Prof. Fessenden, containing 20 pages of drawings, 53 diagrammatic views, and 220 claims; the whole forming a most instructive and interesting memoir of the very latest advance in the art of wireless telegraphy.

Engineering Education.

BY CHAS. H. HINES.

THE papers presented on this subject at the convention of the Institute at Great Barrington were excellent as bearing on the proper training of the college graduate and his future career, yet it seems to be taken for granted that the only method in which the profession of electrical engineering may be recruited is from the products of the various institutions of technical training in that particular line, and the writer regrets that not a word of encouragement was spoken in behalf of the many men who are earnestly striving to achieve success in this line, without either the time or money necessary to enable them to attend a college, or even a technical school, and it is with the purpose of offering some words of hope to such as these that this article is written.

To a certain extent the successful engineer, like the genius, is born, and not made; yet this fact is rarely recognized in choosing a life's career, and to many young men the idea comes like the man in Dickens' story who says, "Hallo, here's a church, let's get married!" and the young man in a similar manner says, "Hallo, here's a profession, let's enter it," entirely regardless of whether he has a natural fitness for the same or not. In another instance the fond parents having observed in their son a taste for playing with some electrical toy, or from the fact of his having successfully installed the intricate mechanism of a front door bell, immediately discern in him a budding Edison or a Tesla, and as soon as possible enter him as a candidate for engineering honors, with the usual result of spoiling what might have been a good man in some other field, and adding another to the list of failures to the electrical profession.

The degree of E. E. can no more make a successful engineer of one not having natural aptitude for the calling than can the hall-mark West Point or Annapolis make an "officer and gentleman" of one who is not so by breeding or instinct; yet there appears to be a growing sentiment to-day that unless a man has graduated from one of the many technical schools or colleges that for him there is no future, no opening in the profession.

Such feeling prevails in the army, where the "West Pointer" looks down upon the volunteer no matter how great his ability, and still more so in the navy, where there is absolutely no hope for the man who is not a graduate of the Naval Academy; and I regret to-day to see that forgetful of the splendid results attained in the past by men whose names are household words, and whose standing in the profession is of the highest, the same feeling is beginning to pervade the electrical field.

I do not for an instant hold, that with the broadened field that now prevails, and the vast strides that have been made during the past decade, that a sound theoretical knowledge is not necessary, but neither do I believe it impossible for the intelligent practical worker to raise himself from the level of a "hewer of wood and drawer of water" if he has the natural aptitude.

Every employer or director of labor in the electrical field, if he is observant of the progress and methods of his men, will notice among them some few whose natural mechanical ability, intuitive grasp of principles, coolness in emergencies and ability in handling men stamp them at once as naturally fitted for the profession in which they are engaged; but usually owing to a deficient early education, or the necessity of having to enter upon the struggle for a livelihood at an age when others who are more fortunate are pursuing their studies, they are handicapped in life's race, and here, it seems to me, that the helping hand may be extended and the rough material fashioned into the perfect work. How, it will be my aim to show later on; in the meanwhile let us compare the two: the theorist, fresh from his "Alma Mater," and the untaught, yet apt toiler.

The young man fresh from his college steps forth into the world as Mr. Venus says, "In the wicious ignorance of youth," expecting that there will be an immediate rush for his services; then finds that he will either have to accept a subordinate position in the works of some large company or else a minor place on the staff of some well established consulting engineer. In the first case, in nine cases out of ten, he feels how superior he is to the work that he is asked to do, does that work in a half-hearted manner, and accepts the first outside position offering him more money, whether capable of handling it or not; and in many cases, proving unsatisfactory, drops out of sight and ken, or joining the staff of some well-known expert who has devoted weary years to the study and practice of his profession, yet who may not be the possessor of a degree, the young man begins by pitying the ignorance of his employer, and hoping in time to impart to him a portion of the knowledge with which his brain is filled, and so, lacking in the practical knowledge of men and things, with a narrowed and unreceptive mind, he rushes boldly in where "angels fear to tread," and in a brief time demonstrates how utterly unfitted he is to deal with the practical side of the profession, until at length his long suffering employer is obliged to more or less gracefully dispense with his valuable (sic) services These are the worst cases, but even with the best ones much valuable time must be wasted in teaching that on leaving college, the education of an electrical engineer has but begun, and that tact, judgment and experience in handling men and materials have all yet to be learned, and this teaching is exasperating and many times costly to the employer, and usually entirely unappreciated by the subject.

On the other hand, we will now take the practical worker who has worked at the different details of the profession, but whose knowledge of the principles involved may, and in most cases does amount to nothing, yet who is most eager to learn, and grasps any crumbs of instruction that may be thrown him with an avidity that is at times almost pathetic; *he realizes* his deficiency, and is willing to do anything that may tend to better his condition and enable him to attain knowledge.

To him there are the correspondence schools, which are excellent in their way, but limited in scope, and to a beginner even they present obstacles which are apt to discourage him, and after spending more or less time striving to untangle some knotty point, he becomes discouraged and is apt to drop out and give up the struggle, and it is here that there is a chance for those employers and directors who possess knowledge to assist those in their employ who have shown the aptitude and desire to learn, of which I have spoken.

This may be done by devoting an evening or two a week in classes formed from among their men, either in conjunction with the correspondence school or text-books, leading them gradually over the first hard places, and demonstrating by interesting talks with simple apparatus and sketches the first principles, thus encouraging them and leading on to the higher steps.

This not only results in benefiting the men, but the employer as well, for as they become more efficient his own labors are lightened, and the work under his charge is done with more intelligent effort on the part of the men so instructed, and the little time given by him is repaid a hundred fold, as I have found by actual trial; the results are really amazing.

I have carried on such classes at different times, and I have never found the interest lag or the attendance diminish, and the results shown in examinations held from time to time were surprising, showing as they did the earnest and thoughtful effort on the part of those who attended; while the results in their work were at once apparent.

Such classes, beginning with simple mathematics, mechanical drawing and the principles of electricity and magnetism at the first, then going on to the higher grades, working in conjunction with a correspondence school or from text-books, are feasible, practical and not only a benefit to the men but to the instructor as well, and result in many cases in starting men on the high road to success in the profession.

In conclusion, I may say that there is also a broad field for the

philanthropist who desires to help those who are deserving of it, by endowing night schools, fashioned after the principles of the Pratt Institute of Brooklyn, N. Y., in all the large cities where the eager seeker after knowledge could carry still further his desire for learning, and many a naturally bright intellect which is now hampered by lack of early training might repay to the world at large by his achievements in the future the money thus expended in his behalf.

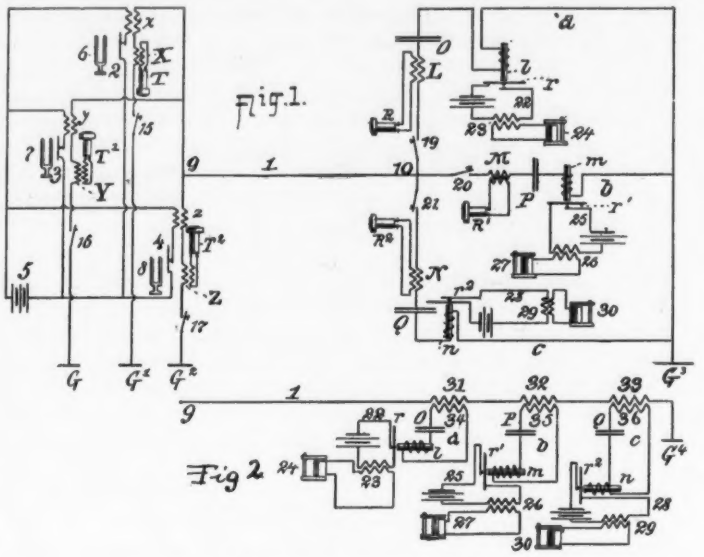
Let us continue to plan and do all we can for the young man who is fortunate enough to be able to afford a college training, but at the same time let us not altogether forget the great army of practical toilers whose patient and unnoticed efforts have made possible the development of the profession to the point at which it stands today, and when we find one among them who is worthy of the chance, give him an opportunity to develop the genius that he may possess.

Multiple Telegraphy by Resonance.

Professor Pupin, who has made the subject of the propagation of electric waves along conductors a subject peculiarly his own, has recently obtained two patents (Nos. 707,007 and 709,008) on a system of multiple telegraphy based on resonance. The object of the invention is to send a number of messages simultaneously over a single conductor by means of periodic currents of different periodicities. When a periodic electromotive force acts upon a conductor of adjustable electromagnetic constants—that is, of adjustable capacity, self-induction and resistance—then by varying the capacity or self-induction, or both, these electromagnetic constants can be proportioned with respect to each other in such a way as to make the natural period of the conductor equal to the period of the impressed electromotive force. The conductor and the electromotive force are then in electrical resonance. The process of adjusting the natural period of the conductor so as to render it resonant is called "electrical tuning." The laws which underlie electrical tuning and electrical resonance are analogous to those of acoustical tuning and resonance, as Dr. Pupin has pointed out in his various original papers on the subject (*Vide Transactions*, A. I. E. E., May 17, 1893).

A resonant conductor offers under all conditions a smaller impedance to the electromotive force with which it is in resonance than to any other electromotive force. Hence, a resonant conductor can act as a current-selector; that is, if it forms part of a system on which a number of electromotive forces of various periodicities are impressed, then its impedance will be smaller to that one of those electromotive forces with which it is in resonance than to any other. Thus, in a system of conductors having adjustable self-induction coils and condensers the coils and condensers can be adjusted in such a way that each conductor will have a different predetermined natural period, and, therefore, each part will resonate to a periodic electromotive force of its own pitch independently of the presence of other electromotive forces. Such a system of interrelated tuned conductors of different periodicities acts, therefore, in consequence of its resonating properties, as a set of current selectors. This forms the essential feature of the invention and its applicability to multiple telegraphy is evident. Dr. Pupin claims the broad method disclosed, of distributing electrical energy, no matter for what purpose it may be used, of throwing upon a common conductor a number of alternate currents of different frequencies, and distributing the several energies of these currents, each selectively to a separate electrical translating device, and he also claims the method disclosed of tuning the various selective parts to different periodicities. These methods can be effected by many different forms of apparatus.

Referring to the drawings in Fig. 1, 1 is the common conductor to which are connected three telephone transmitters, 2, 2 and 4, in circuit with the battery, 5. The secondaries of the transformers, *x y z* of 2, 3 and 4, are connected in parallel to wire 1 at *g*, and to ground at *G* G^1 G^2. In front of each transmitter is a tuning fork, 6 7 8, each tuned to a different note, so that three periodic e. m. fs., each of a different periodicity, will be impressed on wire 1. At the receiving end are three branch circuits, *a b c*, having coils, *L M N*, for furnishing the auxiliary self-induction, and condensers, *O P Q*, for furnishing the auxiliary capacity, by the proportioning of which self-induction and capacity the auxiliary conductors are tuned. The three branch circuits are grounded at G^3. The auxiliary parts of the branch circuits are the telephones *R* R^1 R^2, placed in inductive relation with the coils *L M N* and the small coils surrounding magnet or soft-iron cores *l m n*, and also three keys, 19 20 21. Suppose it is required to send a message from transmitter 4 to branch *a*. Coil *L* has a predetermined self-induction, and condenser *O* a predetermined capacity, their values being such as to render branch *a* resonant to, say, a frequency, *C*, the note of fork 8. The telephone T^2 is acted upon inductively by coil *Z*. The sound of the telephone, *R*, calls the attention of the operator in circuit *a*. He answers by tapping key 19, the breaks being heard in T^2. He then closes the battery circuit, which works the receiving transmitter, *r*, and the receiving instrument, 24, is then ready to receive the electrical impulses from the line. These impulses are given in the following way:



FIGS. 1 AND 2.—PUPIN MULTIPLE TELEGRAPH.

When operator at 4 closes key 17, an alternating current of frequency, *C*, passed to branch *a*, and acting on *l* sets diaphragm of *r* in vibration, producing an induced current of the same frequency in secondary of 23, which current passing through coil of sounder 24 repeats the signals sent by 17. This set of signals will in no way be interfered with by the simultaneous transmission of signals between branch circuits *b* and *c* and transmitters 2 and 3 as long as different frequencies are used. An adjustable condenser may be used in series with each receiving instrument to reduce its electromagnetic impedance to a minimum for the frequency to be used in that branch. There may be any number of branch circuits at each end of the line, and each branch can operate simultaneously as transmitter and receiver. In the diagram only the transmitting apparatus is shown at

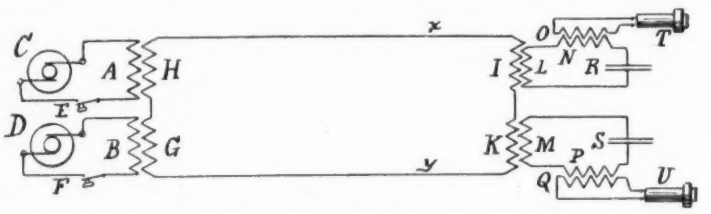


FIG. 3.—PUPIN MULTIPLE TELEGRAPH.

one end and the receiving apparatus at the other; but in practice each would have both, and any number of sets might be connected in the one branch, all to work with the same frequency. In Fig. 2 the branch circuits are shown inductively connected with the main line, the primaries of the transformers 31 32 33 being in series. They may also be in multiple.

In the second patent, Dr. Pupin shows, in Fig. 3, a system which is substantially like that of Fig. 2, but at the transmitting end is preferable to that of Fig. 1. A number of generators, as *C* and *D*, suitably constructed and operated to generate currents of desired periodicities, are inductively connected to the line *x y* through transformers *AH BG* with keys *E* and *F* in the primary circuits. At the receiving end are the branch selective circuits connected by coils *IL*, *KM*. Adjustable condensers, *RS*, and adjustable self-induction coils, *NP*, telephones, *T*, *U*, constructed with secondary coils *O* and *Q*, complete the branch circuits, one of which is tuned to respond to the current of *C*, and the other to that of *D*.

Dr. Pupin says it is not possible to calculate mathematically the values of the self-induction and capacity required for a complex system, though the mathematical theory suggests in a general way how the tuning should be done. The use of iron in the coils should be avoided; the ohmic resistance of the secondary circuits should be as small as possible. The adjustable coils should have as large self-induction as possible, and the condensers should be adjustable in small steps. With these general cautions, each branch should be tuned to one of the periodic currents by varying one or both of the electromagnetic constants until the maximum effect is obtained. It is usually necessary in a complicated system to make a preliminary tuning of all the branches and then make a final and more accurate tuning. When the branches are once tuned to the appropriate frequencies they are left unchanged. The final tuning is done by adjusting the frequency to suit the electromagnetic constants of the circuits, for it is impossible to reach in each branch the point of true maximum selectivity by varying only the constants. Having, therefore, adjusted approximately the circuits to respond to the periodicities previously selected, the final step to be made is then to vary the frequencies. This is easily done where electromagnetic oscillators are employed.

The system described by Dr. Pupin has no moving synchronous parts. It is applicable either to selective signaling or to multiplex telegraphy, and whether it finds practical application or not, it is a highly interesting and original contribution to the telegraphic art. It serves as one more illustration of the valuable results that applied scientific investigation and mathematical reasoning frequently have to offer to the practical industries.

Improvement of Motor Meters.

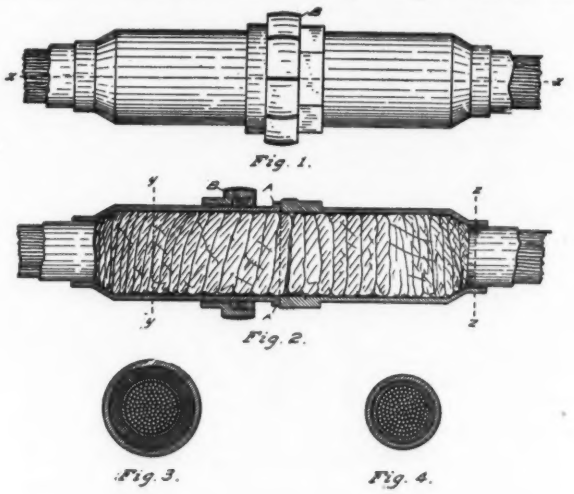
An interesting patent on improvements in motor meters was issued to Prof. Elihu Thomson last week, on an application filed in January, 1900, his object being to simplify and cheapen the construction, and render the operation of the meter uniform over all ranges of load. It is especially applicable to meters operating under direct current. A register is provided, driven by a meter-motor at a speed varying with the load on the consumer's circuit, in which the meter is installed in a manner usual with electric meters, and a motor comprising an armature or torque-producing element formed of a plurality or flat or "pancake" coils moving in a magnetic field of constant strength. The field for the sake of cheapness and convenience is excited by one or more permanent magnets, between the poles of which the pancake-coils are mounted for rotation. As many such coils as desired may be employed and symmetrically disposed about the axis of rotation and supported in a common plane, to which the load-current of the consumer's translating devices is led through a suitable commutator, formed of three segments, and a corresponding number or multiple thereof of armature coils. The small number of segments also permits the commutator to be made of small diameter, thus rendering brush-friction low. A type of commutator suitable for the purpose is that employed in the Thomson-Houston three-coil arc lighter. In shunt to the armature is a resistance of such value as to take the maximum portion of the current flowing through the meter.

With an organization of the kind just outlined, the effect of the friction of the moving parts is such that it is impossible to so adjust the meter that it will register the energy consumed with substantial accuracy both at low and at high loads. If the meter is so adjusted that its registration is accurate at the normal load for which the meter is constructed, there will be a considerable inaccuracy in the registration at very low loads, due to the fact that the friction of the moving parts, which is substantially constant at all speeds, becomes a greater proportional part of the load as the load on the meter decreases. The load due to the friction of the moving parts is, however, small in comparison with the load on the meter when full-load current is flowing in its actuating windings. It is, therefore, possible to materially increase the accuracy of registration at low loads without decreasing by so great an amount the accuracy at full load by so adjusting the meter that its registration will be correct at some point intermediate between zero and full load, the particular point being determined in accordance with the range of load to which the meter is likely to be subjected. The meter when thus adjusted will, of course, register too low at low loads and too high at full loads; but its accuracy will on the whole have been substantially increased. It is not, however, possible by such an adjustment to make the registration accurate at all loads up to the full-load limit for which the meter has been designed.

Prof. Thomson states that it is possible to so modify the organization above specified that the registration of the meter may be made substantially accurate both at light loads and up to the maximum load for which the meter is designed, and one of the features is a corrective which will obviate the inaccuracies above referred to and will render the registration of the meter truly proportionate to the load on the circuit. A retarding-magnet system comprises, in addition to the damper which slows down the speed of the meter motor at all times, an auxiliary damper, consisting of an electromagnet carrying a current varying with the load in the consumer-circuit, and provided with an iron core so proportioned that its magnetization will be raised to or near the point of saturation as the meter load approaches a maximum. The magnetization of this auxiliary damper is, of course, nil at zero load; but as the load comes on its damping tendency rapidly increases until when the load appraches a certain value, where the core of the electromagnet approaches saturation, the curve representing the retardation due to the auxiliary damper becomes flattened, and the effect of the said damper thereafter substantially the same as that of a permanent magnet. With such a construction the meter is so adjusted that it registers with substantial accuracy at full load when the core of the auxiliary damper is saturated. As the load falls off, that part of the retardation which is due to the auxiliary damper falls off at first slowly, and later at an increasing rate as the magnetization falls below the bend in the "curve of magnetization," until finally when the load reaches its minimum value it becomes practically nil. By properly designing the electromagnet constituting the auxiliary damper its effect may be made to exactly compensate for the frictional resistance of the moving parts of the meter, so that the curve of registration will be substantially a straight line up to the maximum load for which the meter is designed, it being understood that beyond this load the curve of registration is likely to fall off somewhat, probably by reason of the disproportionate counterbalancing effect of the counter electromotive force generated in the meter-armature at such loads.

New Telephone Patents.

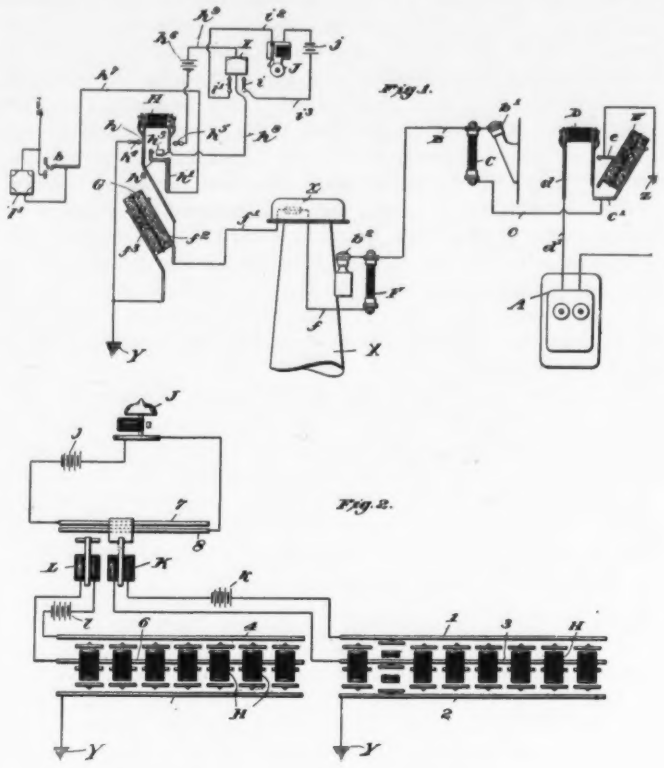
The issue of the Patent Office for August 12 contributes to telephony four patents, all relating to auxiliary apparatus, three covering protector devices and one a screw connection for cable splices. The inventor of the latter device is Mr. Thomas P. Jones, of Olyphant, Pa. The device is simplicity itself, consisting of two tubes, which are slipped over the cable sheath (and presumably soldered to it, though the specification does not say so), and joined together by means of a nut on one sleeve which screws over a threaded collar on the other. The drawings illustrate the device sufficiently clearly to make further description unnecessary. Fig. 1 shows the completed joint, Fig. 2 a section with the nut *B* not screwed home, Fig. 3 is a section on line *y y*, and Fig. 4 a section on line *Z Z* of Fig. 2. When the two sleeves of the union have been slipped on the cable, and the wires spliced in the usual manner, the cable is wrapped with waterproof paper or other covering of sufficient quantity to fill completely the space within the body part of the union, when the nut



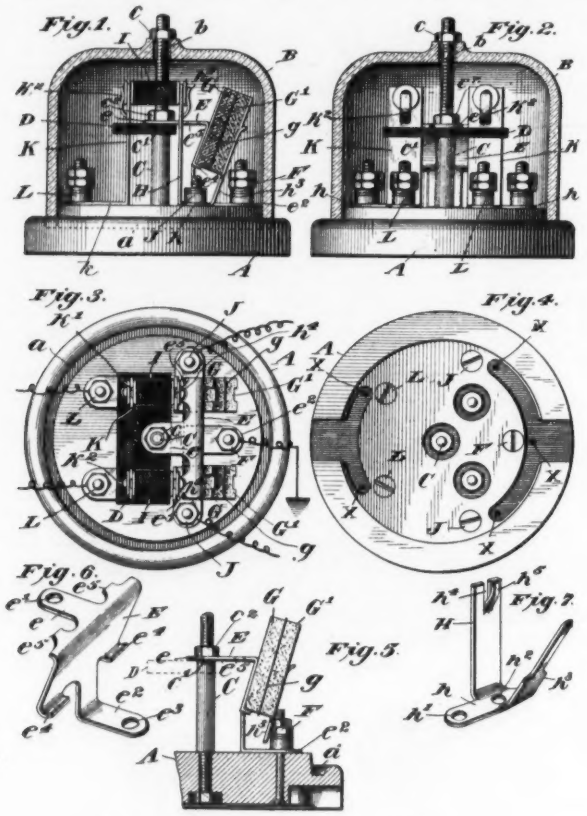
FIGS. 1 TO 4.—JONES TELEPHONE CABLE CONNECTION.

B is screwed home, compressing the covering or wrapping, making a solid air-tight joint. Mr. Jones claims that his device supplies a rapid method for connecting telephone cables, affords facilities for repairing wires where connected when necessary, makes a more rigid and durable connection than the method commonly used, and provides for disconnecting the cable when desired. The weak points, however, are that the sleeves must be soldered to the cable sheath to make a moisture-proof joint, and the splice in a paper-covered cable must be "boiled out" before the union is closed, so that a screw-joint is neither more rapid nor more accessible than one made by the method commonly used.

Mr. Frank B. Cook, of Chicago, as is well known, makes a specialty of protectors. In the ELECTRICAL WORLD AND ENGINEER for July 19, 1902 (Vol. XL, No. 3, p. 97) was described a heat coil device due to Mr. Cook, and this he now follows up with three patents on protectors and various arrangements thereof, having a fourth withheld by the Patent Office in order to determine the question of interference. The original application for the present patents and the one in interference was filed July 29, 1896, and divisional applications were filed May 21, 1902, so that Mr. Cook's protectors have occupied the attention of the Patent Office for quite a considerable period. One patent relates to a protector set to be used at the subscriber's station one to a system of strong current protection, embodying all the required protective elements and a signal system to indicate the position of a protector, which has operated, and a terminal box equipped with protectors. For his protector set, Mr. Cook claims "a simple and compartively inexpensive construction, whereby a plurality of electrical protectors may be combined and efficiently employed in a compact and easily accessible structure." Further, the protectors are so mounted as to be easily connected with the circuit wires, and there are details and features of improvement making for general efficiency and serviceability. Referring to the drawings, as shown in Figs. 1 and 2, the protectors are mounted on a porcelain base, *A*, and covered by a glass dome, *B*, secured by a nut, *c*, on the central post, *C*. The heat coil used is that described in Mr. Cook's patent above referred to, which has a metal cap or plug that pulls out when the coil operates, allowing the



FIGS. 1 AND 2.—COOK SYSTEM OF PROTECTION.



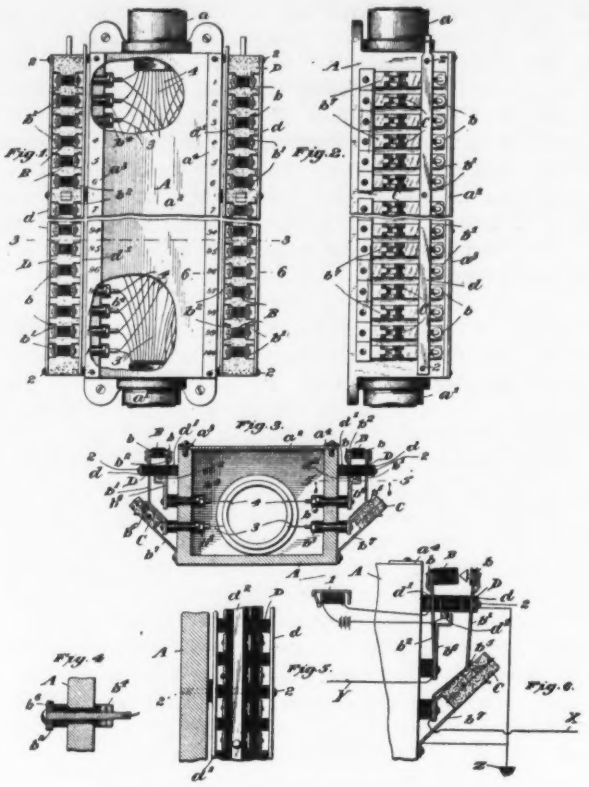
FIGS. 1 TO 7.—COOK PROTECTOR SET.

supporting spring to bend outward. The coil, *I*, is held between the stationary spring, *K*, and the moving spring, *H*, the peculiar form of which is shown in Fig. 7. The plate *E* (Fig. 6) is held on the insulating plate, *D*, resting on a shoulder, C^1 on post *C* by nut C^2, on the shoulders e^4 it supports one plate of each of the arresters, *G* G^1, and the shoulders e^5 are adapted to make contact with *H* when *H* is released by the action of the heat coil. It will be seen that the upright spring of *H* passes behind *E*, and its inclined spring h^3 holds the plate G^1 against the plate *G* supported on the shoulder e^4 of *E*. The plate *E* is connected to ground at *F*, and each *H* plate is connected to a line wire. The two plates, *G* G^1, are separated by a strip of silk, *g*, which will be burned out by a heavy stroke, allowing the carbons to come together. The *L* binding posts are connected to the subscriber's instrument, and the *F* posts, carrying the *H* plates are connected to line. Thus it will be seen that the operation of either coil will ground the line by allowing an *H* spring to come in contact with *E*, and similarly the burning out of the silk, *g*, of either arrester will cause the same result. Mr. Cook seems to have produced a neat and compact protector set.

The second patent aims at a general comprehensive system, including fuse-protectors, heat-coils and carbon lightning-arresters, an arrangement whereby any heat-coil will signal its operation, and an arrangement of the protectors in banks, and so equipped with signals that a general alarm will be given when any protector operates, and also a signal set indicating the bank containing the operated protector. The line fuse protector shown by Mr. Cook is the portion of his protector inventions which finds itself in interference. Referring to the diagram, Fig. 1, *C* is the line fuse protector in dispute attached to the suspended line wire outside the subscriber's premises and *F* is its mate at the central office end of the line, attached in the same way; a cable box or pole terminal connection being indicated at *X*. The heat-coil and arrester devices are those described in the previous patents, as clearly indicated. At the central office the spring, h^1, which is released outwardly by the operation of the heat-coil, has a bent portion, h^2, adapted to make contact with the plate h^3, and contact being also made with stop h^5, the releasing of the spring closes the circuit of relay, *I*, which indicates the protector operated, and also closes the local circuit containing alarm bell *J*. Fig. 2 illustrates the arrangement of the heat-coils in banks or sections, arranged according to the method just described so that a general alarm will be sounded when a coil has operated, and a special signal will be set indicating the bank in which the operated coil is situated.

The third patent covers a terminal box equipped with protectors and including the signaling circuit for announcing the operation of a protector and indicating its position. The terminal box, as shown by the drawings, is the standard form of cable head, and the protectors of the form already described are mounted on the sides in the usual manner. Numbering strips, a^3 a^4, are attached to the edge of the cover a^2. The springs of the heat-coil, *B*, pass through a slotted bar of insulating material carrying metal strips, *d*, on its outer edge, with which spring b^1 makes contact when a coil operates,

d^1, on its inner edge to receive b^2 and d^2 below to receive the bent contact spring, b^3. The strips d^1 and d^2 form the contacts for closing the signaling circuit or relay *I*, as shown in the diagram, Fig.



FIGS. 1 TO 6.—COOK TERMINAL BOX.

6. The details of the terminal and arrangement of the protectors are so clearly illustrated by the drawings as not to need further description.

CURRENT NEWS AND NOTES.

LINEMAN WITH SIX LIVES.—A lineman was fatally shocked while handling an electric light wire in Mount Vernon, N. Y., recently. The coroner's verdict was that the victim met his death by being "electrocuted six times by an electric light wire containing 1,500 volts."

NAVY WIRELESS TELEGRAPHY.—Communication between Washington and Annapolis was established last week by wireless telegraphy under the auspices of the Navy Department. The distance is about 35 miles, which in view of other achievements the officials have decided not to treat as sensational.

THE JUNEAU-SKAGWAY SUBMARINE CABLE line is again out of commission. After a recent windstorm in Alaska, the cable was found to be damaged. It is supposed that the heavy seas caused the armor to be worn off by chafing on the rocks. The Signal Service Bureau will make repairs as soon as possible.

A LONG FREE TELEGRAM.—The Pope celebrated his name-day on August 17. Among the telegrams of congratulation was one of 20,000 words from the Catholics of Catania, Sicily. The receipt of this long message caused no little amusement at Rome in ecclesiastical and other circles, as, under the agreement or settlement with the Italian government, all telegrams for the Vatican are accepted and delivered free of charge.

MARCONI IN LONDON.—A special cablegram to the New York *Sun* says that Mr. Marconi arrived in London August 13. He declared that he was satisfied with his recent experiment of wireless telegraphy on board the Italian flagship "Carlo Alberto," by which messages were received at Cape Skagen from Poldhu, Cornwall, and signals at Cronstadt from the same place, distances, respectively, of 850 and 1,400 miles. He says these experiments prove that transatlantic wireless telegraphy will be successful in the future.

CHILIAN TELEGRAPHS.—The Director-General of Telegraph, in his report to the Chilian Government covering the year 1901, states that expenditures in the course of the year for telegraphic installations amounted to $29,881, and for telegraph wires, $76,329.51. The total length of new wires put in place was 169 kilometers. The number of telegrams dispatched in 1901 is detailed as follows: Private telegrams, 1,231,000; words, 16,974,413; value, $581,-004.12; official telegrams, 140,146; words, 4,681,633; value, $148,-009.57. The cost to the State of the telegraph line to the Argentine Republic is given as $126,332.

AERONAUTICS FOR ST. LOUIS FAIR.—We have received from Prof. W. E. Goldsborough, of the Department of Electricity, of the St. Louis, 1904, Exposition, a copy of the rules and regulations relating to the aeronautic competition, for which $200,000 has been appropriated, half of which goes in a grand prize. One prize of $3,000 is offered for "a successful attempt to drive an air-ship motor by energy transmitted through space, either in the form of electric radiation or in some other form of electrical energy, to an actual amount of one-tenth of a horse-power at the point of reception, and at a distance of at least 1,000 feet." The test must be made on the Exposition grounds by the experts of the jury.

BOSTON AUTOMOBILE MEET.—It is stated from Boston that under the auspices of the Boston Automobile Club, the Boston Gentlemen's Driving Club is making arrangements for what is to prove the greatest automobile race meet ever held in this country, at Readville, in October. There is already a promising list of entries, prominent amateurs, including Mr. Vanderbilt, have been invited to participate, while negotiations are being made with professionals for what are expected to prove popular features. It is expected that about 185 carriages, representing the Automobile Club of America, will be at the club after the endurance run from New York, and it is expected that a number of New Yorkers will send over their fine racing vehicles to compete. The home club probably will entertain the visitors, after which all will join in a run to Readville. It is believed the Readville track is well adapted for auto racing.

THE MACKAY WILL.—Mrs. John W. Mackay and her son, Clarence W. Mackay, filed the will of John W. Mackay at Virginia City, Nev., last week. The will bears date of July 14, 1898, and was made in this city. Declaration is made in the first paragraph of the will that all the estates of the testator are the common property of his wife and himself. The will bequeathes all of his estates subject at the time of his death to Mr. Mackay's testamentary disposition to his son, Clarence Hungerford Mackay. The wife and son are named as executors without bond, and are given power to sell or dispose of the estate in any way they see fit. The principal property of which Mr. Mackay died possessed consists in stock of the Commercial Cable and Postal Telegraph companies, bonds of the Southern Pacific and Canadian Pacific Railroads, and real estate and mining property in Texas, California and Arizona. The value of the estate is estimated at between $50,000,000 and $75,000,000. The witnesses to the will are Messrs. A. B. Chandler, E. C. Bradley and W. H. Baker.

OLD MENLO PARK.—The New York *Times* has a pathetic note about the decay of Menlo Park, New Jersey, where Edison did so much of his famous early work. "Edison made Menlo Park famous all over the world and in the old days there were many visitors to the little place. Even to-day many persons suppose the main laboratory of Edison is still at Menlo Park, and scarcely a day passes that the postmaster does not receive some letter addressed to Edison. Those were boom days for Menlo Park. Besides the Edison plant two other factories were built, and it looked as if the place had a bright future. Then Edison removed his plant, and the prosperity of the village came to a sudden stop. Little by little Menlo Park sank back to the condition of a country village. The railroad steadily decreased the number of trains stopping there. To-day an air of almost melancholy quiet broods over the place. Although the plant has fallen into decay Edison still owns it. His family have large interests in Menlo Park. A short distance east of the former laboratory stands the old Edison homestead, which is the property of Mr. Edison's daughter. In its time it was an imposing structure. Tenants were hard to find, the buildings fell into decay, and finally an Italian family were allowed to live in it rent free."

LARGE TRANSFORMERS.—What are said to be the largest electric transformers ever manufactured have been put in operation at Chambly and Montreal. These transformers are 20 in number and have a total capacity of 750,000 lights. By their use the current at Chambly is raised to a voltage of 25,000, and transmitted at that pressure to Montreal, where it is lowered to 2,000 volts.

MARCONI STATIONS THROUGHOUT THE WORLD.—It is announced that Mr. Vyvyan, engineer in charge of the erection of the Marconi wireless telegraph station at Table Head, will leave shortly for South Africa, where he will superintend the erection of a similar station at Cape Town. It is likely that he will first put the Cape Breton station in operation before leaving. The plan of the Marconi Company is to establish, as soon as possible, a chain of long-distance wireless stations in different parts of the world. Within a year, it is expected, there will be one station in Canada, two in the United States, one in Central America or the West Indies, one in South Africa, and one on the continent of Europe.

A MULTIRATE METER has been patented to Mr. A. D. Lunt, and involves details controllable from a central station or other suitable point for altering at will the rate of registration of energy consumption on a distribution system or portion of a system fed from said station, the operation being effected without the employment of any additional conductors between the meter and the central station, and without the utilization of a ground on the system, as has heretofore been proposed. This result is accomplished by the employment of an actuating device located in the vicinity of the meter, arranged so as to respond to alternating currents of suitable selected frequencies sent over the distribution system from the central station. A current of one selected frequency, for example, will serve to move the actuating device in one direction, while a current of some other selected frequency causes an opposite movement. The movements thus produced may be utilized to change the rate of the meter in any usual or ordinary manner—as, for example, by cutting in or out resistance in the armature circuit of the meter or by shifting the registration from one recording device to another.

NIAGARA POWER IN CANADA.—The Ontario government has so modified the regulations governing the grant of additional water privileges at Niagara Falls to the Ontario Power Company that no further opposition is anticipated from the Canadian Power Company, the original lessees of the Falls power. Both companies will proceed now on a basis of 50,000-hp development each, and it is understood that the bulk of the power has already been arranged for. The Toronto-Niagara Power Company, which will bring the Canadian Company's power to the city of Toronto, expects to use about 20,000 horse-power in the city and the immediate vicinity. This will displace something like 200,000 tons of soft coal per annum, now imported from the United States. At the recent meeting of the Niagara Falls park commission, the application of the Ontario Power Company for permission to take water from Niagara River as well as from the Welland River, was argued with the result that the commissioners will recommend to the Ontario government that the application be granted, subject to the condition that the company must submit detailed plans of the proposed works to the Commissioner of Public Works for Ontario. An opportunity then will be afforded to the Canadian Power Company to state any objections which that company may have to the proposed plans.

HANGER FOR TRANSFORMERS.—Mr. J. J. Wood, the well-known electrical engineer of Fort Wayne, Ind., has taken out a patent on an improved hanger for transformers, etc. It is customary to suspend transformers from the cross-arms of poles by means of a supporting member having its upper end bent to fit over one of the cross-arms, and which is generally called a "hook." The casing of the transformer is usually attached to the hook by means of bolts passing through the hook and carrying nuts at their ends at the back face of the hook. These nuts often coincide in position with a lower cross-arm, so as not to interfere with the proper setting of the hook. When it is desired to remove the transformer, the nuts have to be loosened, and as they have usually rusted fast by exposure to the weather, and as the operator is in a very difficult position for working a wrench, the releasing of the transformer from the hook is a matter of considerable difficulty. When the nut is finally withdrawn it is often lost, as well as the bolt. Mr. Wood avoids these disadvantages by the provision of a supporting member (which may be in the shape of the usual hook) which has an uninterrupted flat rear face, so that it may lie evenly against the cross-arm, no matter at what position the latter occurs. Complementary engaging parts on the supporting member and the casing are provided for clamping the supporting member with the casing, comprising a lug stud, corresponding members on the front engaging the lug and locking securely. The annoyance of losing small parts, such as bolts or nuts, is avoided by permanently connecting the attaching means to the supporting member. The difficulty occasioned by the necessity of using a wrench upon a rusted nut from a seat on the cross-arm of a pole is avoided by the provision of a wedge which holds the parts fast together, but which may be released by a blow in the proper direction from a hammer or other tool.

OBVIATING TROLLEY ELECTROLYSIS is the purpose of a patent granted to Mr. H. F. Parshall, the American electrical engineer now practicing in London. He establishes in the various railway sections, corresponding to the several feeders of the system, an assisting electromotive force tending to prevent the dispersion of the currents through the earth by establishing what might be regarded as a negative potential at the rails in the several track sections, thereby establishing a condition which might be loosely described as an "electric suction" in the metallic path leading to the distributing station. At the distributing station are installed electromotive devices, corresponding in number to the number of feeder sections in the system, and connected by independent conductors with the rails or return circuit at points of the track varying in distance from the distributing center. For such purpose he uses a motor generator having two independent armature and field-magnet windings, one pair acting as a motor and the other as a generator or booster. One set of these armature windings in the several electromotive devices has one terminal connected to the several trolley-supply sections, and the other to a generator lead close to the station. The other set of armature windings has each one terminal connected with earth at the distributing-station, the other with the rails or return conductor at points varying in distance from the station. Thus the electromotive devices have their driving members operated under a voltage varying with the distance of the point protected and their driven members supplied with an assisting electromotive force varying in a corresponding way. The range of potential of the return circuit above or below that of the earth connection at the station existing at different points of the system is in many places regulated by rules established by boards of trade or other authorities. This voltage is always low, amounting to only a few volts. It is evident that with such low pressure in view of the excellent conductivity of the metallic return circuit provided, but a small proportion of the current will leak to earth and be a possible source of damage to intervening pipes or metallic structures. The invention comprises one or more motor generators located at the distributing station, each motor operating under a constant field and having its armature operated at a voltage proportionate to the distance from the station of the point to be protected, and having its generating boosting winding connected with the return circuit at such point as to divert the earth currents and to assist their flow back to the station through a metallic path.

LETTER TO THE EDITORS.

The Effect of Electric Waves on the Human Brain.

To the Editors of Electrical World and Engineer:

Sirs.—In your issue of June 21st there appears a criticism by Mr. Collins of methods described by us in an article on "The Effect of Electric Waves on the Human Brain," which was published in your issue of May 31st, and while disclaiming any wish on our part to enter into a controversy with Mr. Collins, we beg to indicate a few points which are apparently not well understood.

The three coherers, as well as the whole apparatus, were those used repeatedly by Professor Rutherford in class and public lectures on "Wireless Telegraphy." While we have Mr. Collins' assurance that a description of these instruments would form an unique chapter in the history of Wireless Telegraphy, yet this, with many others of his statements, we beg to doubt.

Again, while Mr. Collins finds accumulators only of service for "operating an automobile" and not for "delicate tests," we can at present think of few cases where dry cells are to be preferred. And why an accumulator with an e. m. f. of 2.2 volts and an internal resistance of (say) 0.02 ohms, is not as serviceable and as suitable for delicate tests as two dry cells of e. m. f. of 2.5-3.0 volts and internal resistance of (say) 0.2 ohms, on a circuit having a resistance of 1000-5000 ohms—our non-cohering minds fail to grasp. We may say that we also used the current from the 110-volt circuit, cutting it down by means of a resistance frame, and using potential differences between 0. and 23 volts. That a "fresh" brain—or a brain of a living animal—conducts electrolytically, we may fairly regard as proven: to the electro-chemist the tests of an electrolyte is whether—or not—the substance gives a polarization current. On passing the current through a fresh brain, oxygen and hydrogen are liberated at the poles; on stopping the current and measuring the polarization e. m. f. it is invariably found to be 1.7 volts—the decomposing voltage for sodium chlorides—the obvious deduction is surely logical.

We made no statement that the brain matter was analogous to alkaline solutions, and what deduction Mr. Collins wishes us to draw from his illustration of the effect of heat on sodium chloride and brain matter, we fail to understand. He is doubtless aware that the brain substance is a complex compound—or combination of compounds—of carbon, with oxygen, hydrogen, nitrogen, phosphorus and other elements. On applying heat the water is first driven off; dry cerebral substances, in the one case, and the dry sodium chloride, in the other, are left. On further heating, the former is decomposed, leaving some carbon, the chlorides of potassium, sodium (magnesium and calcium), ferrous phosphate, etc.—the total ash amounting to 2.9-7.1 pts. per 1,000.

Similarly, sodium chloride heated to a high temperature under pressure, would be decomposed into chlorine and sodium; the sodium could then be condensed and a "conductor" thus obtained. But how would this result enhance the value of Mr. Collins' argument? Does he mean to imply that the brain matter is actually decomposed into carbon by the passage of electric waves? Of course there is no experimental proof at present, pro or con, for such a supposition; but if so, reasoning by analogy, truly an ordinary thunder storm would be direly pathogenic in its effects. While we have condemned Mr. Collins' telephone method as defective—since auditory judgments are always more liable to be erroneous than are visual; the ear, no matter how unprejudiced the observer may be, often hears at the telephone what it desires to hear;—yet we have "in an unobstrusive little foot-note" (and in two other places in the course of our article) spoken of Kohlrausch's method of measuring resistances. As Mr. Collins is doubtless aware, this is effected by means of a telephone and an alternating current, with freshly platinized electrodes. This method gives an accuracy of .1%.

Mr. Collins defends his method by referring to the fact that Signor Marconi used the telephone receiver in his most crucial test; we are fully aware of the fact, but would beg to remind Mr. Collins that just as his experiments were "qualitative and not quantitative," so the difference between his "brain-coherers" and those of Signor Marconi, was qualitative rather than quantitative. We are prefecly willing to admit the delicacy of the telephone receiver, when carefully manipulated, but we most emphatically do not admit that it is as decisive and as impossible of an erroneous interpretation as is the milliammeter, an instrument which leaves nothing to the individuality of the observer. Not only, however, did we fail to detect any change of resistance in the brain with a milliammeter, but an attempt to do it with Kohlrausch's apparatus, was equally unsuccessful. That is to say, with our apparatus the coherer effect in the brain did not amount to 1-10th of 1 per cent.; to measure closer we thought useless, since a change in temperature of 1-20° C. would mean a change in resistance of 1-10th of 1 per cent.—(Textbooks of Physiology—Schaffer, Kirke, Mills, etc.)—this, be it remarked, in spite of the fact that the resistance in the control coherers dropped from 35,000 to 4 ohms when the waves were passed from the same distance.

We are still inclined to doubt that this can be satisfactorily explained on the basis of electrostatic stresses in the intervening dielectric as proposed by Mr. Collins. Moreover, since no difference could be detected in the coherer action when placed at distances of 4, 10, and 25 feet from the coil, all influence from "disrupted discharge through the field of force" etc., must have been entirely negligible.

Mr. Collins regards the fact that our transmitter was capable of sending waves 500 miles as an objection to our having placed the coherer 4, 10 and 25 feet away. His next sentence: "At that distance a coil giving a maximum spark of 2 cm. will act upon a properly constructed coherer without any disrupted discharge through the field of force set up by the surging of the low-frequency, high-potential currents alone"—is evidently intended to give the clue to his line of reasoning; in which case we must confess that we are utterly at a loss to see the connection.

To pass from the physical to the physiological aspect of the phenomena attributed by Mr. Collins to the Hertzian waves, we beg to draw his attention to the fact that "hypnotic suggestion" had absolutely nothing to do with our explanation of the accident quoted—the phrase is Mr. Collins' entirely. A great majority of people have either seen a person faint or have themselves "felt their heart stop," in the popular phrase, for an instant, when under the stress of some violent emotion: death from shock is simply a similar condition carried to a further stage. As Mr. Collins accuses us of believing in action at a distance, without being able to trace either the nature or the paths of the agency at work, we may, perhaps, be pardoned if we trace somewhat fully the actual course of events.

As a result of something taking place in the external world, waves of light or sound reach the special senses, and are conveyed to the centers in the brain as nerve impulses which they affect so as to cause sensations of sight and hearing. When these afferent impulses are sufficiently powerful, disagreeable, or painful, they cause a lesser or greater degree of paralysis of those centers governing the functions most necessary to life, such as respiration and circulation.

The result is an immediate and pronounced lowering of the blood pressure, with consequent cerebral and medullary anaemia, causing, first, loss of consciousness, and later, arrest of the cardiac and respiratory functions. At the same time the blood pressure may fall so low that the coronary circulation is impoverished and the heart itself dies from lack of oxygen.

But as a discussion of this subject would belong more to the province of medicine than electricity, we beg to refer Mr. Collins to the authorities quoted: we may, perhaps, be permitted quotations from such recognized authorities as Dr. Osler and Dr. Lauder Brunton.

"Bodily shock or concussion is not necessary. The affection may follow a profound mental impression; thus, an engine-driver ran over a child and received thereby a very severe shock, subsequent to which the most pronounced symptoms of neurasthenia developed."[1] Dr. Osler then goes on to cite cases in which fatal organic changes in the brain and cord have supervened.

"Convulsive movements and fibrillary twitches of the muscles, and especially of those in the face, are observable."[2] (Cf. twitching of cephalic muscles in case of rabbits.)

"Nor must the effect of mental emotion be left out of account, as this is sometimes sufficient of itself to cause death without any injury to the body whatever."[2] The author then cites the case of an absolutely healthy man who was blind-folded and "beheaded" by means of a blow with a wet towel on the nape of the neck; death was instantaneous.

Under the predisposing causes of shock, Dr. Dawbarn mentions fear as a very considerable factor; he narrates the death of a man, "apparently of sheer cowardice, some hours before the time set for operating upon piles."[3]

Does Mr. Collins imagine that we regard "hypnotic suggestions" as the cause of death in these and similar cases? Most assuredly we do not: but as he has not apparently a very clear idea of what he means by that term, we beg to refer him to Professor James, of Harvard, in whose work he will find a very lucid resumé of the three main theories of hypnotism.

The lessened surgical mortality under anæsthetics is due to the fact that these deleterious afferent impulses are prevented from reaching, or at least being "apperceived" in the nerve centers, and are thus unable to cause reflex medullary paresis. Mr. Collins was able to obtain a cohering action in an anæsthetized brain, and consequently, unless he is able to give a totally different reason for all the cases of death mentioned in the references, we shall maintain that not only are his experimental methods defective, but that his reasoning is also inconsistent.

Again, if Mr. Collins were able to obtain a cohering action in a brain under the much deeper narcosis of ether, how does he reconcile that result with the fact that a child may sleep—if kept quiet

and very tired—through a thunderstorm which would cause it the most acute terror when awake? According to his theory, the child, too, should have a much more powerfully cohering brain—his theory assumes that all such phenomena of terror, etc., are due to a cohering action of the brain.

To conclude: Mr. Collins, after some experiments tending to prove that the brain is a coherer when a coil giving a 2-cm. spark is used, deduces an explanation of death "from shock" during an electrical storm. This theory we have attacked, and until Mr. Collins supplies evidence to the contrary, we shall continue to think that waves from an apparatus with a 5 or 50-centimeter spark-gap are as much like those propagated during an atmospheric electrical storm as are waves from his apparatus.

Our thanks are due to Drs. Barnes and Morrow for their valuable criticism and advice.

1. Osler:. Practice of Medicine, pp. 1132-1135.
2. Lauder Brunton:. Practitioner, XI., p. 241-258.
3. Dawbarn:. Shock. New York Medical News, 1899, LXXIV., 299-234.
4. Crompton: Guy's Hosp. Reports, 1887, 3s. XXIX., 150.
5. Reeve: Medical News, Philadelphia, 1887. L 6,—Death from Introduction of an Aspirator.
6. Thomas: Lancet, 1898, ii., 1390.
7. Barrow: Lancet, 1898, ii., 323.
8. James: The Principles of Psychology, Vol. ii., 593-616.

It may be noted that only a few of the more easily accessible instances among a mass of such literature have been chosen.

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DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

Dynamos, Motors and Transformers.

Compound Non-Synchronous Motor.—Latour.—A communication in which he replies to the communications of Feldman and Heyland. He has built a machine of 27-hp, in which the commutation is perfect. With twice the normal current there is no sparking whatever. As motor, this machine operates with a power factor equal to unity at any load; it runs above synchronism at no load and synchronous at full load. But he could also operate it like Heyland, synchronous at no load and below synchronism when loaded; he, however, prefers synchronism at full load. No shifting of the brushes is required in practice, the slip causing only very slight disturbances in the commutation. As a generator, his machine retains enough permanent magnetism and becomes at once self-exciting, like a direct-current shunt dynamo. Without a shifting of the brushes, and when the constancy of the frequency is of no importance, he generally operates it below synchronism at no load and synchronous at full load; but, like Heyland, he could run it synchronously at no load and above synchronism when loaded. He concludes with the following sentence in italics: "If my generator is compounded, it remains theoretically synchronous at any load."—*Elek. Zeit.*, July 3.

Induction Motor.—Lindstroem.—An article on the calculation of the characteristic curves of the induction motor. There exist two such methods: the one graphical, by Heyland, which in its simple form enables one to find very quickly the approximate properties of the motor; the other analytical, by Steinmetz, distinguished especially by the fact that it gives exact results. The present author describes another method for determining the characteristic curves of the induction motor; he starts from a diagram and then applies only simple trigonometry; the method is based upon Kapp's transformer diagram, but Steinmetz's terms are used; the result of his method is identical with that of Steinmetz, and the calculation requires about the same amount of work. The method can be used for single-phase motors and motors connected in cascade.—*Elek. Zeit.*, June 17.

References.

Direct-Current Machines.—Trylski.—A communication referring to a recent paper of Niethammer, in which he had discussed the conditions of sparkless running of direct-current machines and the influence which the type of winding has upon it. The present author describes some experiments which show this influence.—*Elek. Zeit.*, June 12.

Shunt Regulator.—Krause, Erlacher, Hanke.—Two illustrated communications dealing with methods for determining the number and values of the steps of the regulator of a shunt generator with self-excitation.—*Elek. Zeit.*, June 19, July 3, 24.

Lights and Lighting.

Experiments with Very Large Electric Arcs.—Rey.—An abstract of a paper read before the International Society of Electricians, in Paris, in which he described his experiments with electric arcs in conjunction with Blondel's work on projectors in 1892 to '94, 1899, 1901, and quite recently with Jigouzo. Among the foremost general conditions to be fulfilled for good regulation, are the use of a compound machine, good carbons and a large steadying resistance. A 250-ampere arc implies the use of a steadying resistance, absorbing as much as 62 volts; this figure applies to the best quality of carbons. The quality of samples obtained from the best firms is still unreliable, but the (French) author states that French carbons are the least unreliable in average quality. From careful measurements made by different methods he concludes that the intrinsic illumination of the crater increases with the current. Photometric measurements show a continuous variation of photometric intensity without any noticeable variation of current. It is quite useless to attempt to follow these changes, and the only resonable method consists in taking average values of numerous series of readings. Referring to researches made with Blondel, he states that a given current sent through carbons of different diameters gives different illuminations, due to the different conditions of cooling. Curves have been plotted by the author with current densities as abscessas and photometric intensities as ordinates, for different carbons, and for two different methods, both of which check quite well, *i. e.*, within 15 to 20 per cent. The equation of this parabolic curve states that the illumination multiplied by the product of illumination and a constant, 200, equals 10,000 times the current density (the units of illumination and current density being not given in the abstract). The law of variation of current density for a given illumination, with the diameter, is as follows: the square of the current is proportional to the cube of the diameter of the carbon, or the current density is inversely proportional to the square root of the diameter of the carbon. Violle has investigated the variations of the illumination by photographic methods, but the present author claims that the interpretation of the photographic proofs is liable to great errors, due to the complex laws of variation of the darkness of the proof with the time of exposure. He claims that no credit can be given to this method, which is said to be worse than the photometric methods of investigation. He states that the actual flux of the arc, due to "occultations" of the negative carbons, reaches only 84 per cent. of the theoretical flux.—*L'Eclairage Elec.*, July 19; *L'Ind. Elec.*, July 25; Lond. *Elec.*, August 1.

Traction.

Third Rail.—Potter.—An illustrated description of a form of construction which is intended to afford protection from ice and sleet for the third rail, and prevent short-circuits caused by careless handling of track tools. The protection consists of a channel iron or plank supported by brackets directly over and about 2½ inches above the third rail. The center of the third rail is 28 inches from the gage line in the construction advocated, and the top 3 inches above the top of the running rail. It is not advisable to locate the third rail lower than 3 inches above the top of the track, for in such cases the contact-shoe, which ordinarily drops 1 inch lower than the third rail, would be in danger of touching the track rails, large frogs and switches, causing a short-circuit. A rectangular section

of rounded top is recommended. The following composition for a third rail is suggested, as not being difficult to obtain commercially while providing a reasonably high conductivity: carbon, not to exceed 12 per cent.; manganese, 15 per cent.; phosphorus, 10 per cent.; sulphur, 5 per cent. The electrical conductivity of a third rail of this composition will be about 60 per cent. higher than that of an ordinary running rail of the same cross-section. Another feature of this construction is a third rail insulator, which consists of a block of wood or vitreous material, with a slot in the top, into which the third rail is laid. The shoe used has a plate of cast-iron, hinged at the point of support and carried by brackets adjustable for height to allow for the wear of the wheels. In specially complicated slip switches, it is pointed out that some difficulty may be experienced in locating the third rail so that the gap may be spanned by the shoe, and in such cases a short length of rail or wire may be placed overhead for a distance of about 50 feet. The approximate estimated cost of one mile of single track of protected third rail with 6-inch channel iron protection is given at $5,663; with 8-inch channel iron protection, $6,315; with 8-inch wood protection, $4,540.—*St. R'y Jour.*, August 2, and *Internat. Ed.*, August.

Grades Stated in Per Cent.—HERING.—A short article calling attention to an ambiguity which exists when a grade is stated in per cent. The percentage is, of course, the vertical rise in feet per hundred feet distance, but the question arises whether this distance is measured horizontally, as it would be on a map, or whether it is the sloping distance, as would be measured by the length of the rail. Authorities differ greatly as to which of the two is meant. The former would correspond to the tangent of the angle, and the latter to the sine. In steam railroad work and when maps are used, the horizontal distance is generally understood, while in formulas for the traction coefficient on grades, the latter is usually assumed. For small grades the difference between the two is quite negligible; up to a grade of 14 per cent. or about 8 degrees, the difference between the tangent and sine is 1 per cent. or less; on steep mountain roads it should be clearly stated which of the two is meant when the grade is given in per cent. In France the expression o/oo is used in place of per cent., and means per thousand instead of per hundred. In England, grades are often stated as the distance in which the rise is 1 foot; that is, they there use the reciprocal of the value used in this country.—*St. R'y Jour.*, July 19.

Electric Brakes for Tramcars.—MUELLER.—A long article, illustrated by many diagrams. He first describes at length, graphical methods for determining the rheostat required for an electric short-circuit brake and for representing the whole mechanical process during braking. He then discusses the disadvantages of the short-circuit brake, namely, that it is dangerous for the motors, and that there is no braking effect on the axles upon which no motors are mounted. An improvement of the short-circuit brake is the electromagnetic brake in which the currents generated in the motor are not destroyed directly in a resistance, but generate a magnetic field, by the action of which a fixed disk and a disk rotating with the axle are pressed against another, so that mechanical friction and eddy current friction is produced. He thinks that electromagnetic rail brakes are an important improvement, and describes the Westinghouse-Newell brake, which he believes to be superior to an air brake.—*Elek. Zeit.*, June 12.

Electric Trams and Trains.—A long editorial on the fact that a steady and substantial decrease in the traffic receipts of English steam railway companies is caused by the running of electric tramways parallel with their steam lines. It would be wrong for those steam railways to think that they have only to equip their lines electrically in order to win back what they have lost. The steam railway company which aspires to compete against parallel electric tramways must be prepared to separate entirely, and at all points, the local from the main line traffic. It is necessary to provide separate and quite distinct tracks for the fast and the local services. On the local lines a service of trains or of separate coaches should be provided running at short intervals, and more closely resembling in its conditions what is met with on a well organized electric tramway.—Lond. *Elec.*, July 25.

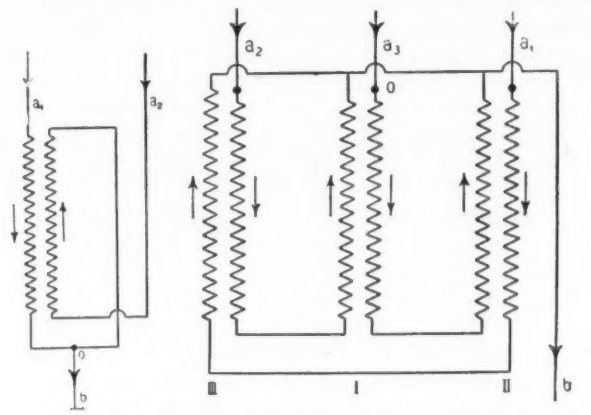
REFERENCES.

Berlin-Zossen High-Speed, Experimental, Three-Phase Railway.—LOCHNER.—A long synopsis of his paper on the results obtained on this railway. The results given by him are in general the same as those noticed in the Digest, May 17. But some additional details are given, together with numerous valuable diagrams and curves.—*St. R'y Jour.*, August 2, and *Internat. Ed.*, August.

New Orleans.—A long and well illustrated article on the New Orleans and Carrollton Railroad, Light and Power Company. The company owns four power houses, two exclusively for electric lighting service and two exclusively for street railway service. Of the latter, one contains three 200-kw and the other two 300-kw railway generators. The traction system is described, and a special article is given on the accounting department of the company.—*St. R'y Rev.*, July 20.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Arnold-Bragstadt-la Cour Polycyclic System of Current Distribution.—ARNOLD.—A long paper read before the Frankfort Electrical Society, illustrated by a large number of diagrams. He begins with the well-known facts that for lighting, high frequency, alternating current is preferable, but low-frequency is better for motors and synchronous converters; for a motor load, a polyphase-current system is decidedly preferable, while for lighting single-phase is better on account of the better regulation and the simpler installation; for motors, double the voltage which is used for lamps is generally more suitable. The object of the Arnold-Bragstadt-la Cour "polycyclic" system is to transmit over one and the same line currents of different frequencies and voltages in such a way that the different currents do not influence one another. He gives some mathematical explanations to show that a sinusoidal e. m .f. can generate only a sine current of the same frequency, and can perform work only with such a current of the same frequency; if there is a second sine current of another frequency in the same circuit, it must be generated by a second e. m. f. of the second frequency; the first current cannot perform work with the second e. m. f., nor the second current with the first e. m. f.; such currents of different frequencies are entirely independent of one another and their energies, powers and losses are simply added. To superpose currents of various frequencies upon another, different methods may be used. The first which he describes is to introduce the superposed current through the neutral points into the system. For instance, in a three-phase system there is an e. m. f. between the neutral points of the transmitting and receiving end, and it is possible to connect the generator which has to give the superposed current—for instance, a single-phase machine—between the neutral points. Diagrams are given showing how to introduce superposed currents into a single-phase or into a two-phase system through neutral points. Bedell has recommended such superposed systems, but in his method the superposed alternating current which is introduced through the neutral point obtains a very large inductive voltage drop in the windings of generators and transformers; this is not the case in the Arnold system. He first describes a method in which a large induction voltage drop is avoided by arranging all windings in a bifilar manner so that the superposed currents cannot act inductively upon themselves. For the introduction of a superposed current, a choking coil may be used, as shown, for a single-phase current in Fig. 1. The two halves of the coil are placed parallel



FIGS. 1 AND 2.—POLYCYCLIC SYSTEM OF DISTRIBUTION.

on the core, but in such a way that the superposed current introduced from the neutral point goes through the two halves in opposite directions, but the main current does not; a_1 and a_2 are the leads to the main system, o is the neutral point; only the superposed current flows through b; the induced actions of the main current in the two halves are added, while those of the superposed current balanced one another. Fig. 2 gives the analagous arrangement for three-phase currents; on core *I* phase 2 and 3 are wound in opposite directions,

on core *II* phase 3 and 1, and on core *III* phase 1 and 2; a_1, a_2, a_3 are the leads for the main three-phase system, while the superposed current flows through *b*. Some modifications are shown in other diagrams. A second method of superposing a current upon a system is by means of transformers which have two primary windings and one secondary winding at the transmitting end, and one primary winding and two secondary windings at the receiving end. Fig. 3 shows the

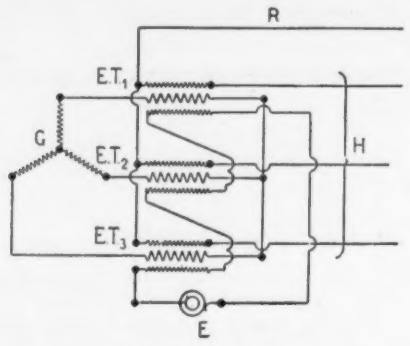


FIG. 3.—POLYCYCLIC DISTRIBUTION.

arrangement for superposing a single-phase current upon a three-phase system by this method. *G* is a three-phase generator, *E* a single-phase generator. *E* T_1, *E* T_2 and *E* T_3 are three single-phase transformers. *H* represents the three main conductors of the three-phase system, *R* the return for the superposed alternating current. The two primary windings of the transformers do not act inductively upon each other. Another arrangement is shown in a diagram, in which a three-phase transformer is used instead of the three single-phase transformers; in another arrangement it is shown how under special conditions a separate return for the superposed current may be avoided. If it is desired to transform the polyphase currents and the single-phase currents, flowing in a polycyclic system at the same time, without separating them, this can be done with the aid of a polyphase transformer with magnetic return, by winding so many turns of the neutral winding (the return of the superposed current) around the magnetic return that the proper ratio of transformation is obtained. It is also possible to induce in the same armature winding of an alternating-current generator, independent polycyclic currents by properly arranging two field systems. He then discusses the distribution of the polycyclic currents in the secondary network and the connections of the transformers which supply, for instance, a three-phase motor load and a single-phase lighting load at the receiving end. He then deals analytically with the voltage difference between the conductors and with the voltage drop of the different currents of the polycyclic system. The following advantages are claimed for the polycyclic system, compared with the usual systems: first, the use of two different frequencies enables one to use the proper frequencies for different purposes; second the connections and installations for light and the regulation of the lighting voltage are very simple; third, the tension for the motor load and the voltage drop in the motor circuits can be much larger than when the same system is used for both power and lighting; this means a saving of

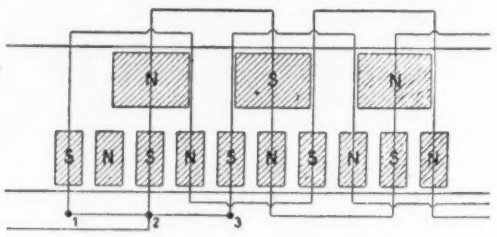


FIG. 4.—POLYCYCLIC DISTRIBUTION.

copper and cheaper motors and generators, because the wattless currents are smaller and of less importance; fourth, if power is transmitted over overhead wires with a four or three-wire system of the power, 100, and a superposed single-phase system of the power, 50, the weight of copper is 66.7 per cent. of the weight of copper required for a single-phase system of the same total power for the same effective voltage between the wires and the same loss of power in per cent; fifth, when power is transmitted over cables, for the same effective voltage between the wires and the same loss in watts, the use of a four-phase system with superposed single-phase current enables one to transmit 23 per cent. more power; the superposed power is then one-half the power of the main system. With a three-phase system, if a superposed current is used, 9 per cent. more power is transmitted if the power of the superposed current is one-half the power of the main system. To show an arrangement of a polycyclic current distribution system as a whole he gives the adjoining Fig. 4. In the double generator, *G* and *E*, with the same armature and two different pole systems which have the relative position to another,

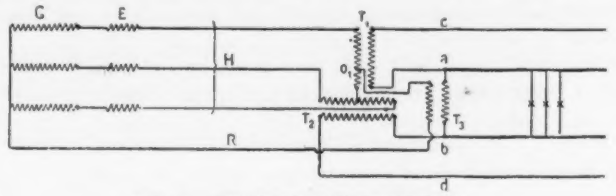


FIG. 5.—POLYCYCLIC DISTRIBUTION.

shown in Fig. 5, the main three-phase currents and the superposed single-phase current are generated at the same time. The single-phase current, which is the triple harmonic of the three-phase currents, is thus superposed upon the main current that the maximum instantaneous voltage between the return, *R*, and the other wires, is a minimum. At the receiving end two single-phase transformers change the current into two-phase currents, the well-known Scott system being used; this is done because, for a polycylic secondary network two-phase is more advantageous in symmetry, than three-phase. The superposed single-phase current does not produce any flux in the two transformers, and can, therefore, be taken off from the point O_1 of the primary winding of the transformer T_1. In the transformer T_2, the superposed single-phase current is transformed, and as the secondary winding is connected between the two wires *a* and *b* of the two-phase system, the lamps can be connected directly across these two wires. The paper is very fully illustrated.—*Elek. Zeit.*, June 26, July 3; *L'Ind. Elec.*, July 10, 25.

Protection Against Accidental High Voltages.—BENISCHKE.—An illustrated paper read before the Berlin Electrical Society. He discusses the different reasons which may cause accidental high voltages. He deals at some length with those dangerously high voltages which sometimes occur when transformers, motors, cable lines, etc., are switched in or out. As a suitable protection, he recommends providing the installation with air-gaps, which have a lower resistance against high voltages than the normal insulation. The ordinary lightning arresters cannot be used for this purpose, because they cannot be adjusted with sufficient accuracy. A curve is given, which shows the length of air-gap required for different voltages; it is nearly a straight line, an air-gap of 1.3 mm. corresponding to 4,000 volts, and 10 mm. to 20,000 volts. If a 2,000-volt installation is to be protected against voltages above 4,000, it must be provided with air-gaps of 1.3 mm. If an ordinary lightning arrester would be provided with such a short air-gap then the short-circuit which would follow a spark discharge would be very heavy, and the electrodes might be fused together. To prevent such heavy short-circuits, he inserts into the earth connection of his protecting device a large resistance; this would not be feasible with lightning arresters. It is, therefore, necessary to install separate and differently constructed lightning arresters and protecting devices against high voltages. For the latter he uses two brass horns; the smallest distance between the same, *i. e.*, the spark-gap, is between the poles of a magnetic blowing device. For the resistance in the earth connection he uses a water rheostat. Some details of construction are described and illustrated. In the discussion which followed, Wilkens remarked that such devices have proven satisfactory in actual service in the Berlin Electric Works, but they use metallic resistances in oil for the earth connection. Benischke explained why water resistances are preferable.—*Elek. Zeit.*, June 19.

WIRES, WIRING AND CONDUITS.

Cables Destroyed by Lightning.—WILKENS.—A brief, well illustrated note presented to the Berlin Electrical Society. He describes the damage done by lightning in a cable line. "From the damage, one sees what an enormous amount of energy there may be in a lightning flash, and that probably all devices used in practice as lightning arresters are not so built that they could lead a direct, full, lightning flash effectively to earth."—*Elek. Zeit.*, June 26.

REFERENCE.

Fuses.—DREEFS.—An illustrated description of a system of Mix and Genest for avoiding any mistakes in the use of fuses.—*Elek. Zeit.*, June 26.

ELECTRO-PHYSICS AND MAGNETISM.

Canal Rays.—W. WIEN.—A paper giving an account of "investigations on the electric discharge in rarefied gases," with some editorial comment upon it. Goldstein, in 1898, described certain rays which were observed to emanate from a perforated or "canalized" cathode. These rays proceed in a direction opposite to the cathode rays and form in fact their prolongation backwards. He called them "canal rays," and maintained that they are not deflected by a magnet. We know that they are simply the positive particles coming from the anode or from the intervening gas, and the present author gives some further information with regard to the aspect they present from the point of view of the electron theory. These canal ray particles, identical probably with the particles constituting polonium rays, are discharged from a glowing carbon filament charged to 3,000 volts, even in a practically complete vacuum. Their mass varies from 250 times to 2,700 times that of the negative electron, and they may very well be the remnant of the atom left after the negative electron has been split up.—*Ann. d. Physik,* 8, 2; an English translation begins in Lond. *Elec.,* July 18.

Canal Rays.—W. WIEN.—An article on fluorescence, due to canal rays. He had already shown that the fluorescence of glass produced by canal rays depends upon the gas in the tube and upon the magnetic deflectibility of the rays. He has since found that canal rays produce fluorescence in metallic oxides obtained by combustion, but not in oxides prepared in the wet way. He supposes that the former are higher oxides than the latter, and that they give off oxygen when positive electrons impinge upon them. Magnesium oxide fluoresces red, zinc oxide a bright green, while aluminum shows patches of various colors. If the cathode itself is oxidized, it also shows fluorescence where the cathode rays originate.—*Phys. Zeit.,* July 1; abstracted in Lond. *Elec.,* July 18.

Gas Spectra in a Magnetic Field.—BERNDT.—An account of an investigation of the general behavior of gas spectra in a magnetic field. The spectra were those obtained from a vacuum discharge through the gas contained in a constriction of the vacuum tube, which constriction was introduced between the poles of a Du Bois half-ring electromagnet giving a field of 20,000 units. Line spectra suffered only little change, whereas band spectra were almost always replaced by the spectrum of mercury. The general behavior of the spectrum is as if the resistance of the gas increased in the magnetic field, which, considering the strong force exerted by the field upon the electrons conveying the discharge, is not surprising. In most of the gases, whether simple or compound, the Zeeman effect is barely perceptible, but helium shows the phenomenon to great advantage in a field of about 10,000 units, about six polarized doublets being discerned with the discharge parallel to the lines of force.—*Ann. d. Phys.,* No. 7; abstracted in Lond. *Elec.,* July 18.

ELECTRO-CHEMISTRY AND BATTERIES.

Lead Zinc Storage Battery.—GABRAN.—An account with diagrams and tables of some experiments with zinc-lead storage batteries. He uses an amalgamated copper case, as negative plate, divided into separate compartments by means of perforated amalgamated intermediate walls; the positive plates are ordinary lead peroxide plates. As electrolyte, a mixture of zinc sulphate and sulphuric acid is used. When discharging from 2.4 to 2.1 volts in 10 hours, he obtained with one battery 331 watt-hours per 14.3 kgr. of total weight. He has experimented a year and a half with these batteries, and has not found any reason why they should not be used in practice. Their advantage over the ordinary lead accumulator is the lower weight of the electrodes and the higher e. m. f. The copper was not attacked.—*Elek. Zeit.,* June 26.

Determining the Condition of the Two Electrodes in the Lead Accumulator.—LIEBENOW.—A German Bunsen Society paper, on the application of the method of Fuchs, which consists in measuring the e. m. f. between an auxiliary electrode and each of the two plates of a storage battery. He describes three different forms of auxiliary electrode. The first consists of a cadmium plate in an ebonite frame, and is sufficiently good for rough determinations. For more exact measurements Liebnow uses solid cadmium amalgam, which is suspended in a small porous bottle, and is surrounded by a solution of cadmium sulphate and sulphuric acid, and is very constant. For very exact measurements a small, carefully treated accumulator plate is suited; as auxiliary for testing the negative plate a small spongy lead plate is used, and for testing the positive plate a peroxide plate, as then very sensitive voltmeters can be used on account of the smallness of the e. m. fs. At the beginning of the discharge the negative plate has an e. m. f. of 0.1 volt, against cadmium; this e. m. f. increases slowly until the plate has been converted into sulphate; after 2½ hours the e. m. f. increases rapidly to about 2.5 to 2.6 volts, if the "discharge" is continued by force, by sending constant current through the cell. On the other hand, the positive plate has at the beginning of the discharge an e. m. f. of 2.1 volts against cadmium, and the curve drops definitely when the plate is discharged. In some cases the Fuchs method gives wrong results, as it seems to indicate that the positive plate is exhausted when it is not the case. Only by continuing the experiment will the real condition become evident. He explains this peculiar phenomenon. In abstract in *Elek. Zeit.,* June 12; the full paper has not yet been published in the journal of the society.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Standard Cells.—JAEGER.—A German Bunsen Society paper. Standard cells can now be made to be exact and uniform within 0.01 per cent., and remain constant within this limit. Several forms of Clark cells are described and illustrated. At 15° C. the e. m. f. is 1.433 volts. The formula accepted by the German Reichsanstalt for the e. m. f., E, in internat. volts at the temperature, t, degrees Celsius is $E = 1.4328 - 0.00119\ (t - 15) - 0.000007\ (t - 15)^2$. The Weston cadmium cell is an excellent standard cell, and has a very small temperature coefficient. He believes that by and by it will entirely replace the Clark cell. For a cell with dilute solution the temperature coefficient is practically equal to zero within the ordinary temperatures; the e. m. f. is 1.0191 internat. volts. The e. m. f., E, in internat. volts of the cell, with saturated solution and crystals, is given by the formula, $E = 1.0186 - 0.000038\ (t - 20) - 0.00000065\ (t - 20)^2$. The cadmium amalgam must have between 5 and 14 per cent. of cadmium. From measurements extending over several years the following values of the ratio of the e. m. fs. of the Clark and the Weston cell were found: Clark at 0 degrees to Weston at 20 degrees, 1.42280; Clark at 15 degrees to Weston at 20 degrees, 1.40669. —*Zeit. f. Elektrochemie,* July 24.

Silver Nitrate Voltameter.—LEDUC.—A paper on the sources of error existing in the silver nitrate voltameter. The change produced in the acidity of the solution is entirely a question of circumstances, such as the rapidity of the electrolysis. The nitric acid generated is electrolyzed, and precipitates silves from the nitrate. A corrosion of the deposited silver does not exist.—*Comptes Rendus,* July 7; *L'Eclairage Elec.,* July 26; *L'Ind. Elec.,* July 25; Lond. *Elec.,* August 1.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Marconi's Magnetic Coherer.—RUTHERFORD.—A communication referring to the magnetic coherer recently described by Marconi. As early as 1897, he himself showed that the demagnetization of magnetized steel wire, by electric oscillations, can be made the basis of a sensitive method for detecting electric waves. He used in the laboratory, for more than a year, a device very similar to that employed by Marconi in his latest form of receiver, viz., an endless moving band of steel wire passing through the solenoid in which the electric oscillations are set up. Instead of using a telephone to detect the magnetic changes in the iron, he used a magnetometer needle, close to which the steel wire passed. "Marconi has apparently applied to the method the principle used by Poulsen for recording telephonic messages with very successful results."—Lond. *Elec.,* July 25.

Coherers.—FENYI.—An article in which he says that an exceptionally strong current can be used with a coherer if the latter consists of a number of steel needles in series. If six needle coherers are placed in series, it is possible to connect them up with a Leclanche cell of 1.5 volts. If several cells are to be used, it suffices to add three or four coherers for every volt of additional e. m. f. In this manner, currents considerably above the standard "milliampere' may be obtained in the coherer circuit. In fact, 100 milliamperes may be used. In an experiment he had six needle coherers, a trembling electric bell and a Leclanche cell connected in a circuit; a small spark excites the coherer and the bell rings; the ringing ceases abruptly as its trembling decoheres the coherer. If the coherer is put to earth on one side and connected on the other side with a very long insulated conductor, an apparatus is obtained which announces distant thunderstorms. If a magnetic recording device is inserted in parallel with the bell, distant thunderstorms may be recorded. A conductor 26 meters long is suitable for most ordinary purposes, but a length of 360 meters gives

ten times the effect.—*Comptes Rendus,* July 7; abstracted in Lond. *Elec.,* July 25.

Wireless Telephony.—An editorial on experiments with wireless telephony. The first method mentioned is Ruhmer's; this is essentially optical, and a modification and improvement of Bell's old "photophone," as has been described before in the Digest. He has succeeded well over a distance of 4½ miles, and will repeat his experiments between stations 20 to 25 miles apart. This method is thought to have a field of application in military, and possibly also in naval service work—for lighthouses, etc. The second method mentioned is that of Preece, who transmits speech across the intervening space between two parallel aerial wires, one of which acts as a transmitter upon the other as a receiver; a battery and a microphone in the transmitting wire and a telephone in the receiving wire complete the equipment; it has never been conclusively settled whether this system operates by electromagnetic induction or by the stray return currents through the earth; but "this is scarcely wireless telephony, the amount of aerial wire used being often much greater than the distance over which messages are transmitted." It is pointed out that neither of the foregoing methods of wireless telephony bears any real relationship to Marconi telegraphy. There are no Hertzian waves used (but they are used in Fessenden's telephone system, according to the meagre descriptions which have so far leaked out).—Lond. *Elec.,* August 1.

London Telephone Exchanges.—An illustrated description of the new small branch exchanges of the Post Office telephone service in London. The system employed has been worked out for exchanges in which the number of the subscribers is not likely to exceed 1,000, and it may be briefly described as a non-multiple system, in which a common battery is used for signaling, but not for speaking purposes. Both as regards the subscribers' and junction lines, the calling and clearing is automatic, as in the ordinary central battery system. Some features of the old Post Office "permanent current" exchanges have been adopted, notably the employment of 8-point jacks.—Lond. *Elec.,* July 25.

MISCELLANEOUS.

Oxy-Acetylene Burner.—A description of a new oxygen-acetylene burner, in which the admixture of ether vapor is dispensed with and a much higher temperature is attained. One volume of acetylene is mixed with 1.8 volumes of oxygen, this quantity being intermediate between the quantities required for combustion to *C O* and complete combustion, respectively. The pressure used is higher than that formerly employed, being that of 400 cm. of water, and the two gases are mixed inside the apparatus, back lighting being prevented by means of porous bricks. The nozzle velocity of the gases must be 100 m. to 150 m. per second. The flame has at its center a greenish dust of extremely high temperature, and only about 6 mm. long. Iron and steel can be soldered at the point with ease, and the flame neither oxidizes nor carbonizes the iron. Silica is fused in volatilized alumina; magnesia and Drummond lime are also fused. On diminishing the quantity of oxygen, the flame becomes luminous, and when it is projected onto chalk, calcium carbide is produced. With a higher proportion of oxygen the flame becomes oxidizing, as may be seen on fusing a piece of iron in it.—*Bull. Soc. Franc. de Phys.,* June 6; abstracted in Lond. *Elec.,* July 4.

Application of Science to the Electrical Industry.—An abstract of a report of a special sub-committee of the Technical Education Board to the London County Council. It is stated that Great Britain, and London in particular, has lost during the last 20 or 30 years various branches of industry owing to the competition of foreign countries, and that these losses are to be attributed in no small degree to the superior education provided in foreign countries. Prof. Comack is quoted as stating that "the prosperity of electrical engineering in America, Germany and Switzerland can be directly traced to scientifically trained leaders."—Lond. *Elec.,* July 18.

New Book.

POCKET EDITION OF DIAGRAMS AND COMPLETE INFORMATION FOR TELEGRAPH ENGINEERS AND STUDENTS. By Willis H. Jones. New York: *Telegraph Age.* 260 pages, 126 illustrations. Price, $1.50.

Telegraphers are severely practical men and not theorists, and Mr. Jones, a practical telegrapher himself, has, in this book, undertaken to lay before his fellow-workers all that is modern in telegraphic apparatus and practice. He, moreover, uses the simplest English in his descriptive matter, which no one can very well fail to comprehend. Theory has been studiously avoided, except to a very limited extent, where it was found necessary as an aid to a better understanding of the principles involved in the construction and operation of the apparatus described.

The 260 pages of subject-matter are well printed, and the 126 specially-drawn illustrations are very clear in treatment. The illustrations consist of diagrams showing the wire connections between the various instruments constituting a set; between apparatus and instruments, etc., and form a very important feature of the book. The work possesses an originality that cannot fail to be interesting to all telegraphers and telegraph engineers. It is divided into 41 chapters, and as these cover such a wide range of subjects their headings are given herewith: Introduction; Magnetism and Electricity; The Dynamo; Electrical Measurement—Formulas and Examples; Magnet Windings; Intermediate Station Switchboard—Methods of Testing and Patching; The Stearns Duplex; The Polar Duplex; The Quadruplex; "Bug Catchers," or Quadruplex Accessories; How to Balance the Quadruplex; The Care and Handling of Quadruplex Apparatus—Adjusting for Greatest Efficiency; Quadruplex Faults and Disturbances; Theory and Arrangement of Resistance Coils for Quadruplex Apparatus Employing Dynamo Currents; The Standard Quadruplex; The Postal Telegraph Cable Company's Quadruplex System; The Roberson Alternating-Current Quadruplex; The Morriss Duplex; Local Batteries—Dynamo Arrangement—Sounders in Multiple—Comparative Efficiencies of Chemical and Dynamo Batteries; Self-induction of Relays—Different Windings Give Different Values; The Storage Battery and its Application to Telegraphy; Polarized Relays for Single-Line Telegraph Circuits; The Equipment of a Modern Telegraph Office; Choosing a Dynamo for Local Circuit; Arrangement of House and Floor Conductors; Arrangement of Apparatus; Switchboards; The Wiring and Arrangement of Multiplex Apparatus; Repeaters; Office Loop Connections; Combination Sets for Duplex or Single-Line Circuits; Formula for Obtaining the Number of Cells of Battery Required to Maintain a Given Strength of Current Through a Given External Resistance; A Simpler Formula for Obtaining the Number of Cells Required; The Telephone; Simultaneous Telegraph and Telephony; The Phonoplex; Wireless Telegraphy; The Wheatstone Automatic Duplex; The Argus Lightning Arrester; The Postal Telegraph-Cable Company's Switchboard Arrangement, and, Practical Instruction for Line Construction.

It is evident from the above list of contents that the work is thoroughly modern, and since it bears the stamp of authority (Mr. Jones being associated with the engineering staff of his company) it will probably become one of the standard works on practical American telegraphy. It is written primarily for operators for the purpose of instructing them about the apparatus with which they have to deal, and this educational feature cannot fail to redound to the benefit of the telegraph service, if the ambitious and energetic operator will recognize in it an opportunity to better his condition. The work is "pocket size" (4½ inches wide by 7 inches high), and bound in stout flexible leather.

Directory of Electrical Societies, Etc.

AMERICAN ELECTROCHEMICAL SOCIETY, Secretary, C. J. Reed, Philadelphia, Pa. Next meeting, Niagara Falls, N. Y., Sept. 15, 16 and 17, 1902.

AMERICAN STREET RAILWAY ASSOCIATION. Next meeting, Detroit, Mich., Oct. 8, 9 and 10, 1902.

THE AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Annual meeting, Hotel Kaaterskill, Catskill Mountains, N. Y., Sept. 2, 3 and 4, 1902.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, W. H. Johnson, Philadelphia, Pa. Next meeting, Mount Washington Hotel, White Mountains, N. H., Sept. 9, 1902.

CANADIAN ELECTRICAL ASSOCIATION. Next meeting, Toronto, Ont., 1903.

INDIANA ELECTRICAL ASSOCIATION, Secretary, Hal. C. Kimbrough, Muncie, Ind. Next meeting, Indianapolis, Sept. 17 and 18, 1902.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Next meeting, Richmond, Va., Oct. 7, 8 and 9, 1902.

NATIONAL ELECTRIC LIGHT ASSOCIATION, Secretary, James B. Cahoon, 136 Liberty Street, New York. Next meeting, Chicago, May, 1903.

NEW YORK STATE STREET RAILWAY ASSOCIATION. Next meeting, Caldwell, N. Y., Sept. 9 and 10, 1902.

NORTHWESTERN ELECTRICAL ASSOCIATION, Secretary, Thos. R. Mercein, Milwaukee, Wis.

THE OLD-TIME TELEGRAPHERS' AND HISTORICAL ASSOCIATION, Secretary, John Brandt, 195 Broadway, New York. Next meeting, Salt Lake City, Utah, Sept. 10, 11 and 12, 1902.

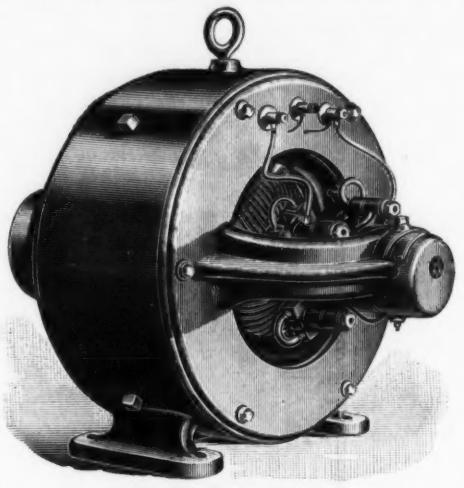
PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION, Secretary, John Ruth. Next meeting, York, Pa., Sept. 10, 1902.

U. S. MILITARY TELEGRAPH CORPS, Secretary J. E. Pettit, Postal Telegraph Company, Chicago, Ill. Next meeting, Salt Lake City, Utah, Sept., 10, 11 and 12, 1902.

VERMONT ELECTRICAL ASSOCIATION, Secretary, C. C. Wells, Middlebury, Vt.

New Towle Motor.

The accompanying illustration shows a new type of motor which has just been put on the market by the Geo. C. Towle Manufacturing Company, of Lancaster, Pa. It is made in sizes ranging from ¼ hp to 7½ hp. The larger sizes (5 and 7½) have been designed so as to make them particularly well adapted to use on electrically-driven elevators. The ring of the motor is in one piece of cast



NEW TYPE OF MOTOR.

steel of the highest permeability. The pole pieces, in one piece, are cast solid on the yoke; obviating any magnetic joint. The armature is of the drum-wound ring type, and well ventilated. The commutator is composed of drop-forged copper segments, and the brush holders are of a neat and thoroughly satisfactory form. The general features of construction can be gathered from the cut.

A De Forest Wireless Telegraph Installation.

At the De Forest wireless telegraph station in this city, on the roof of the Chesebrough Building, was installed last week one of the kerosene engine transmitter sets which has been ordered by the War Department for the coming Fall manœuvers, and which is soon to be located at Ft. Griswold, New London. The engine, which is remarkable for its close and accurate speed regulation under sudden changes from no to full load, is belted to a special 1-kw, 500-volt alternating-current generator, and to a small Crocker-Wheeler exciter.

The 500-volt circuit is broken by the special key, shown in the accompanying cut, and passes through the primary of a special transformer whose ratio of transformation is unity. The object of this transformer is to prevent any high-potential, high-frequency surgings from the condenser discharge from getting back into the generator. Before this arrangement was adopted, considerable trouble was experienced in the way of punctured collector rings and armature windings. As an additional precaution, the frame of the generator is grounded.

The secondary current from the choke transformer is led through a special transformer giving 25,000 volts on its high potential side. This high voltage current passes through a series of specially designed choking coils and is led to the terminals of the spark gap in shunt around a condenser.

To the two-spark gap and condenser terminals are also connected the antenna and ground wires. The capacity of the high potential condenser is adjusted to suit the output of the generator used; and with the 1-kw generator here described can be equal to 6 or 8 quart Leyden jars in parallel. With this capacity across the gap, a spark of surprising volume and fierceness is generated, yet without anything of a flame accompanying it. This result is partly due to the peculiar type of disk or "toadstool" spark terminals used in the De Forest transmitter, whereby the gap is divided into two sparks

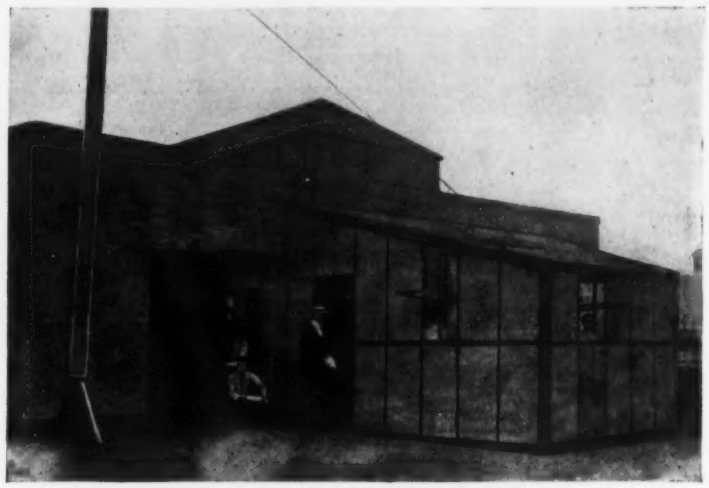


FIG. 1.—EXTERIOR OF STATION.

in series, each of only moderate length, one-quarter inch. The spark-gap is always placed in a vertical position, and the tendency to flame or flare out by gusts of wind is reduced to a minimum.

The ease and rapidity with which the current of this De Forest transmitter, even up to one horse-power, can be made or broken by the special key shown is said to be remarkable. As recorded recently, the De Forest operators have attained a record speed of 52 words per minute with this key, and messages are sent regularly at the rate of 20 to 30 words per minute.

In view of the two suits which are now pending between the de Forest and Marconi wireless telegraph companies, respectively, a brief description of the working of the De Forest-Smythe receiver will be of interest. The "responder" works, it is said, on the anti-

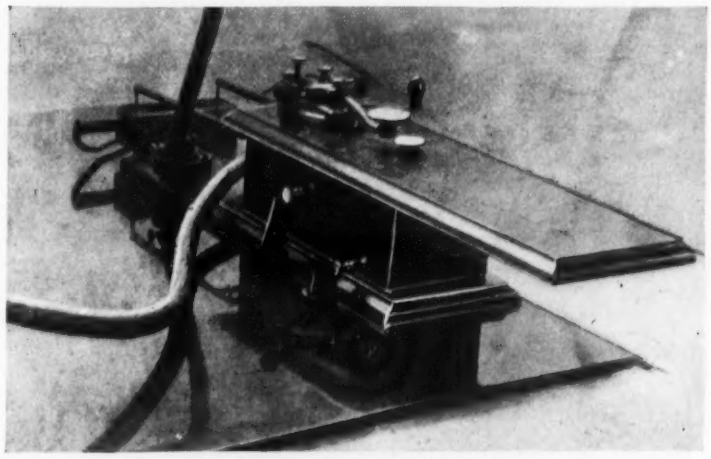


FIG. 2.—TRANSMITTING APPARATUS.

coherer principle, entirely distinct from that of the Branly tube; and in this connection it may be noted that the De Forest Company have just been allowed their main patent on the anti-coherer principle. This embraces 65 claims, all in the "anti-coherer" field. The "responder" of the De Forest Company is believed by them to be the first anti-coherer to be made an actual, practical commercial device, and while the specific claims in the above-mentioned patents refer to the electrolytic principle, these general claims cover a far broader field.

The inventors of the "responder," De Forest and Smythe, started from the bare physical phenomena discovered in 1899 by the German, Neuschwender. The device discovered by him was merely a scratch on a tinfoil mirror on which water was deposited. It was non-

sensitive and altogether unreliable, being entirely useless as a wireless telegraph receiver, even over short distances.

Dr. De Forest for two years has carried on a series of careful scientific researches on this electrolytic principle, studying the theory involved and the requisite conditions for a practical responder. The device to-day is said to differ as materially from that described by the German as does the modern steam turbine from the tea-kettle of Watts.

The full history of these interesting investigations would make a valuable addition to scientific literature. In the responder, under

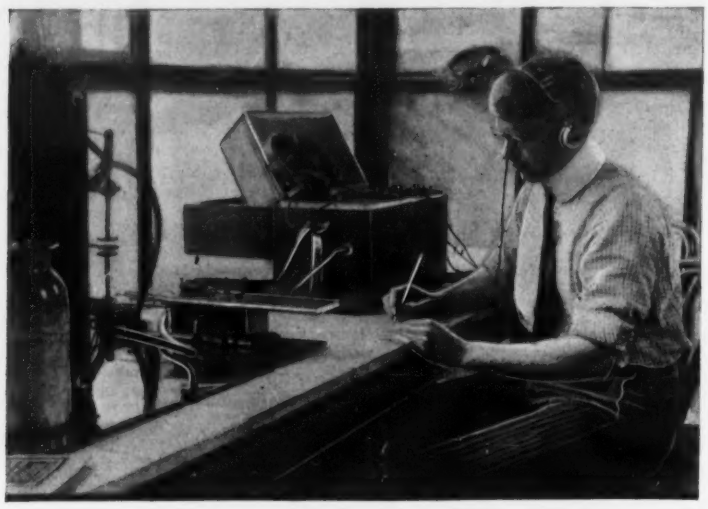


FIG. 3.—RECEIVING APPARATUS.

the influence of the local battery, chains of conducting particles bridge and close the gap between the two electrodes. When the electric impulses traverse this gap, minute bubbles of hydrogen and oxygen are generated from the electrolyte used. This generation suddenly disrupts the conducting bridges, and the resistance is greatly increased. Instantly the wave impulse ceases, the original conductivity of the bridges is automatically resumed, and, no matter how rapidly the sparks at the sending station follow one another, the responder opens and closes in perfect unison. The simplicity of the receiver, freedom from errors in relays, etc., together with a practically unlimited speed, would seem to render it very useful for wireless telegraphy.

New Automobile Motor.

The Lincoln Electric Company, of Cleveland, has put on the market a new automobile motor, which is herewith illustrated. It

AUTOMOBILE MOTOR.

is a 1½-hp motor, equipped complete ready to hang under a carriage. This includes hanging or supporting bars, rawhide pinion, brass gear, cut-steel sprocket and countershaft mounted on ball bearing. This countershaft and motor are arranged so as to connect to a large sprocket near the center of the rear axle. With a motor equipped in this way, it is necessary only to set the motor on the carriage and connect the chain between the sprocket on the motor and the driven sprocket. No special supporting gear is required. This type of support has been used for some time, and has given satisfaction to the Lincoln Company and its clients.

The New "Dublarm" Type of Laminated Circuit Breaker.

The piece of apparatus illustrated herewith operates as a combined hand switch and circuit breaker. The general practice heretofore has been to close the circuit breaker and then the hand switch, so that in case of an overload or short-circuit the breaker will instantly open. The I-T-E "Dublarm" circuit breaker dispenses entirely with the usual hand switch. It consists of a circuit breaker and a switch so constructed that either side of the circuit breaker may be closed first; and on closing the other side, thus completing the circuit, the breaker will instantly open, if there is an overload or short-circuit on the line. Both poles being closed, an overload or short-circuit will open them simultaneously.

The device is specially serviceable for feeder protection on account of its compactness, saving in the expense and complication of switches and connections, and allowing more feeders to be placed on one panel, by using the space formerly occupied by the hand switch. Being provided with a hand trip, it can be instantly opened by hand, thus em-

LAMINATED CIRCUIT BREAKER.

bodying all the features of a hand switch together with those of a double-pole circuit breaker.

Large sizes are made triple pole for the protection of generators running in parallel, the third pole serving as the equalizer switch. The smaller sizes, on account of their compactness, are largely used for the protection of lighting circuits, where in case of a short-circuit opening them they can be instantly replaced, thereby insuring constant service. The Cutter Company, of Philadelphia, owns the patents under which this type is built.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—Money closed at 4½ per cent. for 60 days, and 4½ to 5 for three, four, five and six months. The bank statement was rather disappointing on the stock market, but had little effect, the volume of business being at the low ebb of quality dealings. The market throughout was irregular, with a sagging tendency toward the close of the week. Western Union developed some strength, and on moderate buying scored a fair gain; the general market closed heavy. The traction stocks shared in the general inactivity, Brooklyn Rapid Transit closing at 66⅞, being a net loss of ¼ point. Metropolitan Street Railway closed at 147⅞, and General Electric at 184½. Western Union closed at 93¼, being a net gain of ½ point. Following are the closing quotations of August 19:

NEW YORK.

	Aug. 12.	Aug. 19.		Aug. 12.	Aug. 19.
American Tel. & Cable.	87	—	Hudson River Tel.	—	—
American Tel. & Tel.	163½	170¼	Metropolitan St. Ry.	148½	147¾
American Dist. Tel.	—	—	N. E. Elec. Veh. Trns.	—	—
Brooklyn Rapid Transit.	67⅝	67	N. Y. & N. J. Tel.	—	—
Commercial Cable	155	—	N. Y. E. V. T. Co.	11⅝	11½
Electric Boat	23	23	Tel. & Tel. Co. Am.	—	—
Electric Boat pfd.	40	30	Western Union Tel.	91¾	92⅜
Electric Lead Reduc'n.	2¼	1¾	West. E. & M. Co.	215	—
Electric Vehicle	6½	5½	West. E. M. Co. pfd.	—	—
Electric Vehicle pfd.	14	13			
General Electric	185	185			

BOSTON.

	Aug. 12.	Aug. 19.		Aug. 12.	Aug. 19.
American Tel. & Tel.	162½	170½	Western Tel. & Tel. pfd.	—	—
Cumberland Telephone	—	—	Mexican Telephone	2¼	2⅜
Edison Elec. Illum.	—	—	New Eng. Telephone	142¼	141½
Erie Telephone	—	—	Westinghouse Elec.	106½	—
Western Tel. & Tel.	—	—	Westinghouse Elec. pfd.	106½	—

PHILADELPHIA.

	Aug. 12.	Aug. 19.		Aug. 12.	Aug. 19.
American Railways	50	50	Phila. Traction	99½	99¾
Elec. Storage Battery.	88½*	88	Phila. Electric	5⅝	6¼
Elec. Storage Bat'y pfd.	87	87	Pa. Elec. Vehicle	—	—
Elec. Co. of America.	8⅝	8¾	Pa. Elec. Vehicle pfd.	—	4

CHICAGO.

	Aug. 12.	Aug. 19.		Aug. 12.	Aug. 19.
Central Union Tel.	—	—	National Carbon pfd.	100	100
Chicago Edison	—	—	Northwest Elev. com.	36½	—
Chicago City Ry.	220	206	Union Traction	15	16
Chicago Tel. Co.	—	—	Union Traction pfd.	—	50*
National Carbon	31	32¼*			

* Asked.

LIGHTING DEAL IN EAST ST. LOUIS.—The Citizens' Electric Light and Power Company, of East St. Louis, Ill., has been acquired by Clark Bros., of Philadelphia, who recently purchased and consolidated all of the electric roads in East St. Louis and the Eads bridge line. The price paid for the electric lighting company was $600,000. The latter company has a lighting contract with the city of East St. Louis which has eight years yet to run. It also has many private contracts, and is the only electric light and power company in East St. Louis. James Campbell, of St. Louis, who was president of the Citizens' Electric Light and Power Company, engineered the deal which resulted in the sale of the plant to the Clarks. He sold all of his holdings, and July 23 announced his retirement from the presidency. In the latter office he was succeeded by L. C. Haynes, vice-president of the East St. Louis and Surburban Electric Railway Company, and the resident representative of the Clarks in East St. Louis. C. M. Clark, of Philadelphia, was elected vice-president, and H. D. Sexton secretary and treasurer. Mr. Haynes has announced that the electric lighting company will be operated in connection with the other Clark interests, which now amount to several million dollars in East St. Louis and the neighboring towns. The new power plant at Winstanley, now nearing completion, will furnish power for both the street railways and electric lighting system. The Citizens' Electric Light and Power Company was organized 12 years ago by H. D. Sexton and others, with a capital stock of $25,000. James Campbell and a number of wealthy St. Louisans were interested in the company.

OMAHA TROLLEYS.—A syndicate of New York bankers, headed by J. & W. Seligman Company, has closed a deal whereby they purchased the Omaha Street Railway from the present owners for 92 cents on the dollar of the stock, the whole amounting to $4,000,000. The new company will get every share of the stock, a large part of which is owned by Marshall Field, of Chicago, and Senator Millard, of Nebraska. E. W. Nash and Guy C. Barton, officials of the American Smelting Company, are also heavy holders of the stock. The property consists of the Omaha Street Railway, the Council Bluffs and Suburban Company, the Omaha and Council Bluffs Bridge and Motor Company, and a bridge over the Missouri between the two cities. It constitutes a monopoly of the street car traffic of the two cities. The Omaha Street Railway Company has a capitalization of $5,000,000, and the Council Bluffs Company, a capital of $1,600,000, and it is stated that the property has paid dividends of 4 per cent. for the past four years.

AMERICAN LIGHT AND TRACTION.—Circulars have been issued by the American Light and Traction Company to the stockholders of the Consolidated Gas Company, of New Jersey, offering to purchase the stock of that company by the issue therefor of stock of the American Company, or by the payment of $17 a share in cash for the stock of the Consolidated Gas Company. The holders of Consolidated Gas Company's stock in case they accept the stock offer, have the choice of receiving for each share $18 par value of the American Light and Traction Company's preferred stock, or $40 par value of the American Company's common stock. It is stipulated that to make the offer effective it is necessary that it be accepted by at least 75 per cent. of the Consolidated stockholders, and in this connection it is announced that already a large amount of stock has been deposited under the plan of purchase. The stock is to be deposited with the Trust Company of America, and the time is limited to August 15.

GERMAN ELECTRICAL INDUSTRY.—A cable dispatch from Berlin, of August 16, says: "The crisis in the German electrical industry is occasioning much discussion. The proprietors of electrical works are bent on finding a remedy for the present ruinous competition and bringing the producing capacity of the works more in harmony with the market's demands. The Bank for Electrical Undertakings of Zurich, which is owned by the Allgemeine Elektricitäts-Gesellschaft of Berlin, discusses the situation in its yearly report, just issued, and concludes that the European electrical companies must adopt the American trust idea, getting all the works under one management and then shutting down the unprofitable ones till the situation improves."

WESTERN UNION STOCK went up gaily last week to 93, chiefly on rumors, it is said, of a Postal deal. The Postal people don't know anything about it. Another story is that there is "gunning for shorts," who sold on the strength of the difficulties with the Pennsylvania road. It is further said that Western Union negotiations to obtain control of the "Telephone Trust" are discussed in Gould circles, though "officially" it is declared that no such purpose is in view. Just what the "Telephone Trust" is does not appear.

MICHIGAN TROLLEYS.—An amalgamation of West Michigan trolley lines has been planned to include the Detroit, Ypsilanti and Ann Arbor and Jackson, Grand Rapids, Grand Haven and Muskegon railways. It is said that an offer of 70 has been made for Ypsilanti-Ann Arbor stock. The capital of the new company will be $15,000,000 to $20,000,000. A strong eastern syndicate is thought to be behind the move, which may mean ultimate consolidation of all the lines with Detroit United, making the big Michigan combine.

DIVIDEND FROM REAL ESTATE.—The Capital Traction Company, of Washington, recently sold to the Government a parcel of land for $550,000. Part of this money will be distributed among stockholders in the form of an extra dividend of 4 per cent., which will be payable August 20 to stockholders of record August 4. The remainder will be invested in the 4 per cent. bonds of the company.

EVANSVILLE BONDS.—The balance of the $950,000 issue of the Evansville Gas and Electric Company, of Evansville, Ind., amounting to $350,000 has been placed on the market. The bonds bear 5 per cent. and are offered at 101 and interest. A block of $600,000 of these bonds found a ready sale in the Chicago market earlier in the year.

CHICAGO COMMONWEALTH.—E. L. Brewster & Co. have bought the Commonwealth Electric $500,000 issue of 5 per cent. bonds. The proceeds of the sale will be used in connection with work on the $6,000,000 plant to be built by the company.

HUDSON RIVER POWER BONDS.—The Hudson River Electric Company has given a mortgage to the Morton Trust Company to secure an issue of $5,000,000 gold bonds.

DIVIDEND.—The directors of the Western Telephone and Telegraph Company have declared a semi-annual preferred stock dividend of 2 per cent., payable August 30.

Commercial Intelligence.

THE WEEK IN TRADE.—Trade prospects, as indicated by the reports to commercial agencies, are favorable. Expansion in the Fall demand for commodities in all the leading markets is noted, and more optimistic views obtain with reference to the Southern cotton crop and its effects on future business. Pig iron production is still restricted by the scarcity of cars, affecting coke supplies, and the anthracite strike; demand is no less active, however. There is plenty of foreign steel offered, but business is not active at the prices demanded, though domestic supplies are scarce. Nothing like the present activity in hardware is recalled. Structural material is sought by car shops and bridge builders, while many office buildings and other steel structures are planned. The less favorable features noted in the general situation are the restriction of trade in summer goods, caused by the cool weather, the continuance of the deadlock at the anthracite coal mines and the unfavorable figures of the July export trade. Collections as a whole are classed as seasonable. The copper market is lower and weak. On Wednesday, 200,000 lbs. of August-September electrolytic were sold on the Metal Exchange at 11.62½, and immediately after the purchasers of this lot bid 11.60 for 800,000 lbs. more of the same grade at the same delivery and were promptly accommodated by the same sellers. The quotations are Lake, spot to September, 11.60 to 11.77½c., and casting, spot to November, 11.50 to 11.60. The July copper production of United States mines exceeded all records. The total output was 26,749 tons, compared with 21,985 tons in July last year. The number of failures, as reported by *Bradstreet's*, numbered 181, against 169 the week previous, and 186 the corresponding week last year.

HARRISBURG ENGINES FOR OFFICE BUILDINGS.—The George A. Fuller Company, of 137 Broadway, New York, has just let some interesting contracts to the Harrisburg Foundry and Machine Works, for engines to be installed for general light and power purposes in new office buildings, now under construction down town in New York. The new Battery Place Building is to be equipped with three Harrisburg engines, representing a capacity of 600 horse-power. One engine will be a 20-inch x 19-inch, to be direct connected to a 200-kw generator. A 16½-inch x 15-inch engine will be direct connected to a 125-kw generator, and a 13-inch x 13-inch one will be coupled to a 75-kw generator. The Wall Street Exchange Building is to have three 16-inch x 15-inch engines, direct connected to 100-kw generators, and a 12-inch x 12-inch engine, direct connected to a 50-kw generator. The new building now under way between 39-42 Broadway, is to be installed with two 18-inch x 18-inch engines for direct connection to 150-kw generators, and a 13½-inch x 13-inch engine, to be direct connected to a 75-kw generator. The contracts for the generators at time of writing were not awarded.

BRITISH COMMERCIAL OUTLOOK.—A cable dispatch from London, of August 6, says: The struggle for trade forms the subject of a report by the Commercial Department of the Board of Trade, issued to-day, in which exhaustive statistics are given comparing the population and commerce of Great Britain with those of her principal business competitors, the United States and Germany, and the conclusion reached is that America and Germany, owing to their greater increases in population, are traveling upward more rapidly than Great Britain. "If peace is maintained," says the official report, "both the United States and Germany are certain to increase the rate of their upward movement, and their competition with Great Britain in neutral markets, and probably even in home markets, will become increasingly serious." The report makes the deduction that in view of changed conditions Great Britain can scarcely expect to maintain her past pre-eminence, at any rate without strenuous effort and careful and energetic improvement in business methods.

SOME C. & C. ORDERS.—The C. & C. Electric Company, of Garwood, N. J., has secured a contract for two 75-kw generators and one 50-kw machine, for installation in the Hamilton Court apartment house, now being built at Philadelphia, Pa. The generators will be direct connected to 110-hp and 75-hp engines, respectively. These engines are to be built by the Watertown Engine Company, whose New York City offices are in the Taylor Building, 39-41 Cortlandt Street. The equipment is to be used for both light and power. J. B. King & Company, of New Brighton, Staten Island, have requisitioned for a 200-kw belted generator, an 85-kw direct-connected one, and a 120-hp motor, as well as a 10-hp motor, which will serve as equipment in their new plaster mills. The C. & C. people have also secured an order for six slow-speed motors, varying from 2-hp to 30-hp, for running blowers in the new Blair Building, Broad Street and Exchange Court, New York. The contract was obtained through Johnson & Morris, of 30 West Thirteenth Street, New York.

TENNESSEE WATER POWERS.—At a meeting of the directors and stockholders of the Knoxville Water Power Company, on August 11, the following New York men were elected: Charles H. Treat, president; H. O. Reed, secretary and treasurer; Henry T. Fay, general manager, and Robert Morris and F. G. Thompson, directors. Messrs. Treat, Reed and Fay were present. The other members of the company are: Vice-President, John T. Wilder; directors, R. W. Austin and Luther M. Parker. The company has been incorporated for $1,000,000, entirely composed of Eastern capital, for the purposes of damming the Little Tennessee River 30 miles above Knoxville, to generate energy for an immense electric power plant to supply lighting and motive electricity to entire East Tennessee. The project will now be pushed to completion as fast as possible, the meeting resulting in that decision after a report submitted by Mr. John Bogart was read approving the scheme.

BUFFALO FOREIGN AND DOMESTIC ORDERS.—The Buffalo Forge Company, through its New York offices, in the Taylor Building, 39-41 Cortlandt Street, has obtained a contract through Sheriff, Swingley & Company, 120 Liberty Street, for an 8 x 10-inch horizontal center-crank engine, to drive a lighting dynamo in their machinery repair shops at Johannesburg, South Africa. An induced draft plant has been ordered for the New York University power station, at Morris Heights. It will consist of a 6-foot fan, direct connected to a 5-inch x 5-inch vertical engine. Another order secured by the Buffalo Company calls for four 6-foot fans, belted to 10 x 12-inch horizontal central-crank engines, for installation in the Morris Heights School, at 166th Street, New York. The United Heating Company, West Broadway and Broome Street, New York, has ordered two 12-inch x 14-inch Buffalo engines.

AMERICAN ELECTRICAL APPARATUS is making remarkable progress in European markets. The Societe Anonyme Westinghouse has found it necessary on account of the great number of orders to make extensive additions to its plant, which has been in operation for only five years. This plant is located at Havre, France, and supplies the territory included in Holland, Belgium, Italy, Switzerland, Spain, France and their colonies and protectorates. Mr. Albert Schmid; well known in electrical engineering circles in the United States, is prominent in the direction of this company, and general manager of the works.

EQUIPMENT FOR J. L. MOTT IRON WORKS.—The J. L. Mott Iron Works, at Trenton, N. J., are to be installed with three 300-kw cross-compound, non-condensing engines, to be built for general power purposes by the Buckeye Engine Company, through whose New York manager, Paul Bigelow, the contract has just been secured. These engines will be direct connected to 200-kw General Electric generators. There will also be a 75-kw Buckeye simple engine, direct connected to a 50-kw General Electric generator, for lighting. The boilers will be of Franklin type.

THE FEDERAL ELECTRIC COMPANY, Washington Life Building, Broadway and Liberty Street, has been awarded a contract for some 200 ceiling and desk electric fans, for shipment to China. The fans are being manufactured by the Colonial Electric Company, of Ravenna, Ohio. The Federal people have also recently secured some fair-sized fan contracts through British and South African sources. A 200-subscriber telephone exchange, with instruments, has been requisitioned by Chilian parties.

BALL ENGINE ORDERS.—The Saginaw Sugar Company, Saginaw, Mich. ,Alma Sugar Company, Alma, Mich., and the Lansing Sugar Company, Lansing, Mich., will have electric plants, the engines being furnished by the Ball Engine Company, Erie, Pa. The Naomi Coal Company, McKeesport, Pa., will install an electric power plant in its mines, the engine being furnished by the Ball Engine Company.

STANLEY APPARATUS FOR MEXICO.—The Stanley Electric Manufacturing Company has secured a contract through the Federal Electric Company, of 141 Broadway, calling for a 200-kw two-phase, central station outfit, complete, with switchboard, etc., which will serve as addition to a plant in Monterey, Mexico. The equipment is intended for both light and power purposes.

MESSRS. PARKE, DAVIS & CO., Detroit, Mich, the well-known manufacturers of drugs and chemicals, are making extensive improvements and additions to their electrical, steam and power plant, the work being done under the direction of George W. Scott, consulting engineer, The Rookery, Chicago.

BOOK TYPEWRITERS FOR CHINA.—The Elliott & Hatch Book Typewriter Company, 256 Broadway, New York, has been awarded a contract by T. P. Terry, of Shanghai, for several machines, which are to be used for making English records of Chinese government documents.

CHIMNEYS FOR RAPID TRANSIT.—The Alphons Custodis Chimney Construction Company has secured the contract for the construction of five 225-feet chimneys, for the central power station of the Rapid Transit Subway.

PAWLING & HARNISCHFEGER, Milwaukee, Wis., makers of electric traveling cranes and hoists, state that the booking of orders remains highly gratifying. Among recent contracts are the following: Minneapolis Steel and Machinery Company, Minneapolis, Minn., two 20-ton cranes with 5-ton auxiliary hoists, one 15-ton crane with 5-ton auxiliary hoist, one 5-ton crane; Crane Company, Chicago, one 2-ton crane; Wisconsin Bridge and Iron Company, North Milwaukee, one 10-ton crane; Baldwin Locomotive Works, Philadelphia, four 10-ton cranes; The Standard Steel Works, Burnham, Mifflin Company, Pa., two 10-ton cranes; Pennsylvania Lines West of Pittsburg, Fort Wayne, Ind., one 10-ton crane; Moran Bros. Company, Seattle, Wash., one 5-ton hoist; Columbus Iron Works Company, Columbus, Ga., one 20-ton crane; Lalance & Grosjean Mfg. Company, Harrisburg, Pa., one 15-ton crane; The Spang-Chalfant Company, Sharpsburg, Pa., two 3-ton cranes; The Ball Engine Company, Erie, Pa., three 3-ton hoist travelers; The Berlin Machine Works, Beloit, Wis., one 15-ton crane; The American Bridge Company, Economy, Pa., five 10-ton cranes, each with two 5-ton trolleys; The Ohio Farmers' Fertilizer Company, Columbus, Ohio, two 3-ton hoists; Betts Machine Company, Wilmington, Del., one 20-ton crane,

CONDENSING PLANT ORDERED.—The Commonwealth Electric Company, of Chicago, has ordered from the Alberger Condenser Company, of 95 Liberty Street, New York, a complete condensing plant, including a surface type condenser of the high vacuum system. A 28-inch vacuum will be maintained. This will be the largest surface condenser on land, having 20,000 square feet of cooling surface. The pumping plant will be a Corliss-driven outfit, consisting of circulating pump, dry vacuum pump and hot water pump. Lake water, derived from the Chicago River, will be used for cooling purposes. The condenser is to be used in connection with a large Curtis turbine generator unit, of new design, and built by the General Electric Company. As the water from the turbine will contain no oil, being really distilled water, it will be used over and over again in the boilers. The boilers are to be of the Babcock & Wilcox type, supplied with superheaters. The installation which is now being contracted for is a 7,500-hp unit, and is to serve as a trial unit, and if as successful, will be duplicated several times.

THE ELECTROLYSIS PROOF CONDUIT CO., of Chicago, have just completed their new factory. Heretofore their capacity has been sold long before the season opened, but with the additional machinery just added, their capacity is now practically unlimited. Heretofore, they have been compelled to turn away as much business as they have taken, but they are now in a position to make prompt deliveries on all contracts. They have just taken a contract for 500,000 feet for one of the new independent telephone companies with the guarantee of 30 days' delivery. The conduit is compressed paper and asphalt, and is not only a perfect insulator but it is also claimed to be one of the easiest to draw cables through. The Chicago Telephone Company report being able to draw a two and five-eighth cable in a 3-inch duct of this make, and at a longer distance than any heretofore handled. The Chicago Telephone Company has already laid over a million feet of this style of conduit this year.

FOREIGN AND DOMESTIC HEINE ORDERS.—The Heine Safety Boiler Company, Bowling Green Building, report recent receipt of a number of fair-sized contracts, for both the foreign and domestic markets. The Great Boulder Gold Mining Company, West Australia, has ordered two 200-hp boilers, for furnishing steam to operate the mines electrically. The Kyoto Traction Company, of Kyoto, Japan, has placed an order for a 250-hp outfit. Home orders include two 500-hp units for installation for light and power use in the St. Charles Hotel, New Orleans, La. The Ice, Light and Refrigerating Company, of Beaumont, Tex., has ordered a 150-hp boiler. Two 200-hp units have been requisitioned by the West Central Electric Company, of St. Louis, Mo. A 150-hp boiler is to be erected in the electric light plant at Jekyll Island, Florida. Woodward & Lothrop, of Baltimore, Md., have ordered three 400-hp boilers, for lighting and power use.

KERN RIVER PLANT.—The Kern River Company, of Los Angeles, Calif., has closed contracts for the equipment of the water-power electric station, from which current will be transmitted 110 miles to Los Angeles. The Bullock Electric Manufacturing Company secured the order for the generators through the Wagner-Bullock Electric Company, of California. The contract calls for five 2,000-kw, three-phase, water-wheel type generators. They are 50-cycle, revolving-field machines, wound for 1,100 volts at 231 r. p. m.; two 150-kw exciter sets, to be operated by independent water-wheels, will be supplied by the Westinghouse Electric and Manufacturing Company. The General Electric Company was awarded the contract for transformers of sufficient capacity for the system. It is understood that Stilwell-Bierce & Smith-Vaile water-wheels will be ordered. R. S. Masson acts as consulting engineer for the Kern River Company.

PNEUMATIC TUBE SERVICE.—At Washington, on August 15, bids were opened by the Acting Postmaster General for the rental of pneumatic tube service in New York, Brooklyn, Boston, Philadelphia, Washington, Chicago and St. Louis. The bids greatly exceed the appropriation of $500,000 granted by Congress to be used for this purpose for the fiscal year 1903. It was announced before the opening that no awards would be made at present, as it will be necessary to make some adjustment among the different cities in order to come within the appropriation. Following are the bids for New York and Brooklyn: New York—New York Mail and Newspaper Transportation Company, Route No. 7, $439,500 per annum, or $16,799 per mile; Brooklyn—New York Mail and Newspaper Transportation Company, $48,163, or $16,799 per mile.

PRINTING PLANT EQUIPMENT.—The Buffalo Forge Company, through its New York City offices, has secured a contract from the Wilhelms Realty Company, of 110 Fifth Avenue, for three engines, which are to be used for lighting and power purposes in the new printing plant of the Sackett-Wilhelms Company, at Grand Street and Morgan Avenue, Brooklyn. The plant is to be operated by electricity exclusively. Some 40 motors, varying from 5-hp to 30-hp, will be installed. The order calls for one 13 x 20 inch x 14 tandem-compound engine, for direct connection to a 100-kw General Electric generator; a 11 inch x 18 inch x 12 inch engine of same type, to be direct connected to a 75-kw General Electric generator, and an 8-inch x 10-inch center-crank engine for direct connection to a General Electric generator of 25-kw capacity.

MONTREAL POWER PLANT.—A new power station, the cost of which will run into the hundreds of thousands of dollars, is to be established at Montreal by the Lachine Rapids Hydraulic Company. Plans have been prepared, and the company is now asking for tenders for a building that will comprise a sub-station, a transformer plant, switchboard and distributing system, auxiliary steam plant and technical offices. The engine room will contain six steam turbines of the newest pattern, with a capacity of 2,000 hp each. It has been the company's intention since formation to put up an establishment of this description. Now that the machinery necessary to its equipment has become standardized, and there is no danger of its being relegated in a few years as out of date, the company has decided to proceed.

WESTINGHOUSE GAS ENGINES.—A few recent orders for Westinghouse gas engines are: Consolidated Industries Company, Batavia, N. Y.—two 250-hp horizontal, 2-cylinder, tandem, double-acting; one 85-hp vertical, 3-cylinder; one 35-hp, 2-cylinder; all direct connected to Westinghouse generators for lighting and power work. Zanesville Electric Company, Zanesville, Ohio—one 85-hp vertical, 2-cylinder. Kelly & Jones, Pittsburg, Pa.—one 125-hp vertical, 3-cylinder engine, direct connected to generator for power purposes. H. Garrison Foundry Company, Pittsburg, Pa.—one 125-hp vertical, 3-cylinder engine. Mingo Junction Water Company, Mingo Junction, Ohio—one 125-hp vertical, 3-cylinder engine.

TOLEDO, OHIO, IMPROVEMENTS.—The Toledo Railway and Light Company, through its president, A. E. Lang, has announced that about $75,000 will be spent in the near future in improving the facilities of the company in this city. The first step will be the construction of car shops and storage sheds on Central Avenue. President Lang states that the property will be sufficient to handle the growing business of the company for years to come. The building will cost from $40,000 to $50,000. Concentration of the work will assist to decrease expenses. The railway and electric lighting department will receive attention in the new plant.

RITTER ELECTRICAL COMPANY.—The Ritter Electrical Company and the Cincinnati Machine Works, Cincinnati, have consolidated as the Ritter Electrical Company, at 118-120 West Second Street, to manufacture arc lamps, dynamos, motors and do electrical and mechanical repairing and general machine work. John C. Mulvihill is president; Charles L. Stacy, vice-president and superintendent of machinery department; Charles C. I. Poland, secretary; Henry Bauman, treasurer, and Adelhart Beetz, superintendent of lamp department.

WESTINGHOUSE, CHURCH, KERR & CO. announce the removal of their New York office from the Havemeyer Building, 26 Cortlandt Street, New York City, to the Maritime Building, 8 to 10 Bridge Street, opposite the new Custom House, and near Bowling Green. The change is the result of a largely increased business. Three floors, the first, second and third, will be devoted to their uses. The new quarters will afford about double the floor space available in their present location.

LIGHTING EQUIPMENT FOR SCRANTON, PA.—The Y. M. C. A. building, at Scranton, Pa., is to be furnished with a 10-inch x 10-inch Standard engine, as well as a 9½-inch x 10-inch one, built by the Harrisburg Foundry and Machine Works, New York offices, 203 Broadway. These machines will be direct connected to generators of 40-kw and 30-kw capacity, respectively. The generators will be supplied by the General Electric Company. The outfit is to be used for lighting purposes.

General News.

THE TELEPHONE.

BIRMINGHAM, ALA.—The People's Home Telephone Company of this place has declared a dividend of 2 per cent. The following officers were elected at the annual meeting: H. H. Stambaugh, president; Henry B. Gray, vice-president; W. H. Hassinger, secretary, and A. F. Adams, treasurer.

SAN FRANCISCO, CALIF.—The Pacific States Telephone & Telegraph Company, which has met with a great deal of competition from barbed-wire fence telephone systems installed by farmers, recently issued a circular announcing that it would equip the fence wire lines with telephones charging a moderate rental. Long distance instruments will be furnished, kept in repair and renewed when necessary. The lines are to be built and repaired by the farmers as far as the boundary of the town where the exchange is located. A single line will serve ten farm houses. The company's representatives will make a thorough canvass of the districts where such a service is likely to be appreciated.

BUNKER HILL, IND.—W. H. Wiles, president of the Bunker Hill Bank, has organized a company for the purpose of establishing a telephone system.

INDIANAPOLIS, IND.—The State Tax Board has increased by $1,720,428 valuations upon which telephone companies doing business in the State must pay taxes, and decreased the valuation of telegraph companies $2,430. The Western Union obtained a decrease of $5 a mile, the valuation being made $57 a mile on 39,346 miles of wires; and the Postal Telegraph Company's valuation was increased from $20 to $25 a mile on 9,001 miles.

CLEVELAND, OHIO.—The Cuyahoga Telephone Company will probably abandon the plan of attempting to secure permission from the present council to increase its rates. It will be impossible to pay dividends until the rates can be raised, but providing there are no serious accidents, President H. A. Everett claims it will be impossible to pay all fixed charges and maintain a considerable surplus. During the first six months of this year the company earned $35,000 in excess of all expenses and interest.

MINGO, IA.—The Mingo Farmers' Mutual Telephone Company, with a capital of $5,000, has been incorporated.

SHENANDOAH, IA.—The Independent Mutual Telephone Company of Shenandoah, capital $50,000, has been incorporated.

FULTON, KY.—The Cumberland Telephone Company has taken charge of the West Kentucky Telephone Company at this place.

HOPKINSVILLE, KY.—The city of Hopkinsville has refused to confirm the sale of a telephone franchise to an outside party for $3.00. The city holds that the Cumberland Company already has a franchise, and that two systems are not needed.

FREDERICK, MD.—Articles incorporating the Maryland Telephone and Telegraph Company of Frederick City have been filed in the clerk's office.

LANSING, MICH.—The Loche Mutual Telephone Company of Ingham County has been incorporated with $100,000 capital to build a local system.

COLUMBUS, NEB.—Messrs. Cottingham and Everett have been granted a franchise to establish a telephone system.

CHARLOTTE, N. C.—The Bell Telephone Company has asked permission to place its wires underground in this town.

MARION, OHIO.—The Marion County Telephone Company has been granted franchises in Agosta and LaRue, and will erect exchanges in both places in the near future.

NORWALK, OHIO.—The Local Telephone Company is connecting up its new instruments, the system having been entirely rebuilt. All party lines have been eliminated.

PORTSMOUTH, OHIO.—The Portsmouth Telephone Company is extending its lines to a number of towns in the county and will open several branch exchanges in the near future. The company has recently been sold by the Federal Telephone Company of Cleveland.

SANDUSKY, OHIO.—It is stated that a syndicate headed by J. F. Laning, of Norwalk, has secured the controlling interest in the Sandusky Telephone Company. It is said that $48 per share was paid for the controlling interest. Mr. Laning is at the head of the syndicate which has secured control of exchanges at Norwalk, Monroeville, and numerous other towns in this vicinity. It seems to be the aim to secure control of all the independent exchanges in Northwestern Ohio.

CLEVELAND, OHIO.—E. A. Ferrin, representing a Philadelphia syndicate, has made a proposition to the Everett-Moore syndicate to buy up the Federal interest in the exchanges at Bowling Green, Fostoria and Findlay. The Findlay exchange is held under option by Findlay people who are already interested in the company. If the Findlay people do not buy, the three plants may be disposed of to the Philadelphia syndicate which is said to be planning to buy up a number of other exchanges in Ohio with a view to consolidating them.

TOLEDO, OHIO.—Barber & Brailey, telephone promoters, have organized the Louisiana Construction Company to build telephone exchanges at Shreveport, La., and surrounding towns. The company has a capital stock of $500,000, of which $120,000 has been paid in. Officers are W. B. Ritchie, Lima, president; M. B. Shaw, Wapakoneta, vice-president; C. D. Crites, Lima, treasurer; C. D Handy, Wauseon, secretary. The above with J. S. Brailey, C. Campbell and Frank Uffer are directors. J. S. Brailey will act as purchasing agent and F. B. Uffer as superintendent of construction. The same parties are interested in the Southern Trading & Contracting Company and the National Contracting Company. They have established plants in the following cities: San Antonio, Texas, 2000 telephones; Austin City, 1200; Taylor, 600; Temple, 600; Belton, 400; and Waxahachie, 400. They are now building toll lines connecting all these cities with Beaumont, Houston, Galveston, Ft. Worth, and Dallas, and are extending them through Indian Territory, Kansas and Missouri.

CHESTERFIELD, S. C.—The Chesterfield Telephone Company will apply for a charter to build a telephone system in this place, the initial capital being $3,000. J. A. Welsh and R. E. Rivers are interested.

ST. MATTHEWS, S. C.—The St. Matthews Telephone Company has been commissioned with a capital stock of $1,000. The incorporators are L. M. Able, J. S. Wanamaker, H. A. Raysor, M. Jaresy and S. Pearline.

SALT LAKE CITY, UTAH.—The Rocky Mountain Bell Telephone Company will extend its line from Beaver to Cedar, St. George, Utah, and Pioche, Nev. At Pioche connection will be made with the Sunset system from the Pacific coast.

ST. ALBANS, VT.—The Franklin County Telephone Company has just completed a toll line from St. Albans to Fairfield Center, two full metallic circuits have been run and some twenty subscribers along the road connected up with the St. Albans exchange. New lines have also been built to Georgia Center where connection is made with the Citizens' telephone line, extending to Georgia Plain, Milton Boro' and Milton. Work is now in progress on an extension to Swanton, Vt., where an exchange will be established and an improved service inaugurated. The many extensions of the company this season, and an increase of 150 subscribers in the past six months, making a total of 600 subscribers in a city of 6,000 inhabitants, is sufficient evidence to the management that the telephone industry is not the "natural monopoly" sometimes pictured and that legitimate business effort is appreciated by the public.

MT. HOREB, WIS.—Mr. Bell, president of the Mt. Horeb Telephone Company, has obtained a fifty-year franchise in Sawyer County to build lines and exchanges.

OSHKOSH, WIS.—The Winnebago Telephone Company, Oshkosh, capital stock $150,000, has been incorporated by A. B. Ferdinand, Walter L. Gold and Kate Kershaw.

ELECTRIC LIGHT AND POWER.

SAN FRANCISCO, CALIF.—The McCloud River Electrical & Power Company recently closed a contract with the San Francisco Construction Company and G. W. Elder for building a concrete and masonry dam on the McCloud River about 20 miles from Baird station, Shasta County, Calif. It is said that a hydraulic development of 27,000 horse-power can be realized in the future, though the initial installation will not exceed 2,700 horse-power. The dam will be 500 feet in length and about 100 feet high. H. C. Wybro is the engineer in charge of the construction work. It is the intention to transmit electric power to nearly all of the towns in Northern and Central California. There is, however, one company already supplying power in this region, which is not largely populated.

PUEBLO, COL.—Taison, Leach & Co., and Devitt, Tremble & Co., Chicago bankers, have closed a deal for the purchase of the Pueblo Gas & Electric Company's property, the consideration being $500,000. Lewis E. Eyman, of Chicago, will be at the head.

WEISER, IDA.—Work will start at once on the new municipal electric light and power plant for Weiser. The waters of the Snake River will be used. Bonds to the amount of $40,000 have been voted.

POCATELLO, IDA.—The American Falls Power, Light & Water Company of Pocatello has turned on power for use in this city over a line 24.8 miles long. The plant has a capacity of 4500 hp and was engineered by J. H. Brady.

EDWARDSVILLE, ILL.—From present indications the franchise recently granted to the J. R. Bennett Company by the authorities of this city to furnish electric light will never be used by the parties securing it. The backers are said to not be satisfied with the conditions of things; that efforts have been made without success to purchase the old plant, and that two plants in a city of the size of Edwardsville would not pay.

EAST ST. LOUIS, ILL.—The East St. Louis Gas Company has filed articles of incorporation at Belleville. The capital stock is $1,000,000 and the incorporators are: Thomas C. Clark, R. C. Dawes, and Henry Wood. The company proposes to erect a gas and electric light plant in East St. Louis. The Clark Brothers, of Philadelphia, recently purchased the Citizens' Electric Light plant at East St. Louis, and the new company, it is stated, intends to enter the field and compete with the Clarks. The new company was negotiating for the purpose of the East St. Louis plant when it was purchased by the Clarks. Negotiations are now pending for the purchase of the Belleville Gas Light and Coke Company's plant, which also operates an electric light plant by some, as yet, unknown party.

FT. WAYNE, IND.—The newly organized Ft. Wayne Electric Light & Power Company has applied for a new 40-years' franchise for commercial lighting. The company offers the city $120,000 for the franchise in forty annual installments, and furnish lights to the city at $15 per year for each lamp.

INDIANAPOLIS, IND.—It has transpired that the Marion County Heating & Lighting Company, which was recently granted a franchise in a certain part of the city is but another name for the Indianapolis Light & Power Company, the franchise being successfully worked through council. The franchise is as good as perpetual, because at its expiration the city has to buy the plant or grant a new franchise. The one corporation has transferred all its stock to the other.

LIVERMORE FALLS, ME.—J. A. Record is to equip a large new machine shop with electric power. He is general manager for the Record Foundry & Machine Company, just formed.

CLEVELAND, OHIO.—The tall electric light mast which for many years has illuminated the public square in Cleveland is being taken down. The lighting authorities have decided that the numerous arc lamps on the mast can be distributed to better advantage. This is the last of a number of similar masts which were erected to illuminate the business section of Cleveland over twenty years ago.

MCMINNVILLE, TENN.—It is stated that New York and Chicago capital-

ists have secured water-power rights at Horseshoe Falls, 13 miles from this place. It is reported that 20,000 horse-power will be developed and transmitted electrically to Nashville and intermediate points.

NASHVILLE, TENN.—The Southern Railway will equip all its dining cars with electric lights and fans as rapidly as it can be done. Some of the cars are already in the shops being prepared for the change. Others will be shipped in return until all are equipped.

HILLSBORO, TEX.—The Hillsboro Electric Company has been chartered with a capital stock of $50,000. Among the incorporators are O. Goodwin and W. C. Ross.

PAYSON, UTAH, will, in the near future, build a municipal electric light plant.

SALT LAKE CITY, UTAH.—The Telluride Light & Power Company has secured the contract for furnishing power and light in the construction of the Niagara Tunnel in Bingham district, Utah.

SALT LAKE CITY, UTAH.—There will be 8000 lights and about 35 miles of wire used on the decorations for the Elk's convention at Salt Lake City. The Salt Lake Electric Company has the contract.

LOGAN, UTAH.—The Hercules Power Company, of Logan, Utah, without notice has raised the rates for electric current from 35 to 75 cents per 16-cp lamp per month. A large number of the business houses have ordered their lights taken out. This move on the part of the Hercules Company will hasten the work on the new municipal plant.

STAUNTON, VA.—C. R. Caldwell and associates have agreed to take over the street railway, gas and electric light plants in this city at a figure stated to be $85,000.

NEWPORT NEWS, VA.—The property and franchises of the Norfolk Heat, Light & Power Company have passed into the hands of the Norfolk, Portsmouth & Newport News Company, in consideration of $125,000.

POMEROY, WASH.—The Washington & Oregon Electric Railway, Light & Power Company has secured a franchise from Pomeroy for lighting the city.

LARAMIE, WYO.—The Laramie Gas & Electric Company has reduced the minimum price of lights by meter from $1.50 to $1.00 per month. The company will also in the near future make extensive improvements to its plant.

CHEYENNE, WYO.—The Cheyenne Light & Power Company will install two new boilers of 60-hp each, two of 150-hp each and one of 200-hp. Two incandescent generators of 1000 lights each will be installed in place of the two generators of 450 lights each now in use. A new engine of 200-hp will also be added. A new switchboard of the latest pattern and numerous other improvements will be carried out.

THE ELECTRIC RAILWAY.

NEWCASTLE, IND.—The Newcastle, Muncie & Alexandria Traction Company has been incorporated with $10,000 capital stock. E. T. Ice heads the board of directors.

ANDERSON, IND.—The Merchants' Traction Company, of this city, has transferred all its franchises and deeds for the right of way for an interurban road to Middletown to Gus M. Hodges, of Dayton, Ohio, for a consideration of $6,000.

MUNCIE, IND.—The Muncie & Portland Traction Company has been incorporated. The capital is $100,000. T. O. Boyd heads the board of directors. The Union Traction Company is behind the scheme and will operate the road when completed.

INDIANAPOLIS, IND.—The Indianapolis Terminal and Traction Company has filed articles of incorporation. The capital stock is $500,000. The directors and incorporators are Hugh J. McGowan, W. H. Schoepf, J. D. Thomas, J. M. Jones and Clarence Winter.

FT. WAYNE, IND.—The Ohio & Indiana Construction Company has filed articles of incorporation with $600,000 capital. H. C. Paul heads the board of directors. The company will build and operate electric roads and power houses in this State and Ohio.

INDIANAPOLIS, IND.—At a meeting of the officers and representatives of the Dayton and Western Traction line and the Richmond Interurban line contracts were entered into by the two companies whereby the former will build from the east to the State line and the latter from the west to the State line, connecting and completing the chain of electric lines between Indianapolis, Dayton, Cincinnati, Piqua, Columbus and other Ohio cities.

INDIANAPOLIS, IND.—The State Tax Board has increased the valuation of interurban electric railroads upon which taxes must be paid from $7,746,452 in 1901 to $9,655,492 making an increase of $1,909,040. The assessment of the Indianapolis and Greenfield line was increased from $7,000 to $11,000 a mile, and the Union Traction Company's line from $8,000 to $13,000 a mile. The Indianapolis Street Railway Company's assessment is increased $1,500 a mile, the valuation being $32,000 a mile for 110 miles.

NEW ORLEANS, LA.—The Pearson syndicate has bought a controlling interest in the St. Charles Street Railway Company. This is the fourth road secured in Nashville by this syndicate.

BAY CITY, MICH.—The council has granted a 30-year franchise to the United Traction Company. This means virtually a nine-year extension to the consolidated company.

LANSING, MICH.—The management of the Michigan Suburban Railroad Company announces that its road which is now operated by steam will be changed to electricity between this city and St. Johns.

TOLEDO, OHIO.—The Toledo & Monroe Railway is to be extended to Detroit by way of Wyandotte and Trenton.

SPRINGFIELD, OHIO.—The Springfield & Washington Traction Company has been granted a franchise in Springfield.

ZANESVILLE, OHIO.—Zanesville parties are securing right of way for an electric railway from Zanesville to Barnesville.

WASHINGTON C. H., OHIO.—The council has granted a 25-year franchise to the Springfield & Washington Traction Company enabling it to enter the town.

NEWARK, OHIO.—Newark people are promoting an electric railway to extend from Newark to Mt. Vernon, by way of Gambier and Martinsburg. John McCrory is making surveys.

CLEVELAND, OHIO.—The Cleveland & Sharon Traction Company has been incorporated with $10,000 capital stock by T. C. Willard, C. W. Dillie, C. G. Mullen, C. W. Wohle and J. C. Young. Frances B. Morgan and Willis B. Hale, promoters of the company, are at the Holland House, New York, arranging for the construction of the road.

SUNBURY, OHIO.—The Delaware, Berkshire & Sunbury Railway Company has secured a franchise through town. It is the intention of the promoters to extend the road to Johnstown eventually.

DAYTON, OHIO.—G. M. Hodges, of Dayton, has an option on the franchises and rights of way secured by the Merchants' Traction Company for an electric railway from Anderson to New Castle, Ind.

SPRINGFIELD, OHIO.—R. C. Gotwald has completed plans for the car barn, machine shop and substation to be erected at Springfield for the Dayton Springfield & Urbana Railway. The car barn will be 100x300.

CLEVELAND, OHIO.—Cleveland parties are securing right of way for an electric railway from Cleveland to New Baltimore, where it would connect with the Akron-Alliance road, giving connections for both places.

PORTSMOUTH, OHIO.—The county commissioners have agreed to grant a franchise to the Ohio Valley Traction Company. Henry W. Miller, Judge Dever and J. I. Hudson are among the promoters of the company.

COLUMBUS, OHIO.—The Columbus, Delaware & Marion Railway has completed a trestle at Slate Hill, 1000 feet long and 65 feet high. The road will be placed in operation from Columbus to Delaware in the near future.

CINCINNATI, OHIO.—Dr. Samuel F. George, president of the Ft. Wayne, Dayton & Cincinnati Traction Company, now states his road will be extended from Ft. Wayne to Chicago, thus making a through line from Cincinnati to Chicago.

STEUBENVILLE, OHIO.—General Manager Flynn, of the Wheeling Traction Company, announces that a new power house, to cost $175,000, will be located at Brilliant. It will take care of the company's interurban lines on the Ohio side.

CINCINNATI, OHIO.—Directors of the Cincinnati, Georgetown & Portsmouth Railway will issue $1,000,000 of 35-year 5 per cent. gold bonds. The road will be extended to Portsmouth with part of the money derived from the sale of the bonds.

CINCINNATI, OHIO.—The tax valuation of the Cincinnati Traction Company has been increased to $179,600. The company originally returned its property at $3,000 per mile, but the Board of Supervisors has increased this figure to $4,000 per mile.

NAVARRE, OHIO.—The council at Navarre has granted a franchise to the Canton-Akron Railway to extend its line through town. This is for the extension of the road to New Philadelphia, now under construction. Practically all the right of way has been secured.

STEUBENVILLE, OHIO.—It is stated that the Steubenville, Mingoe & Ohio Valley Traction Company will build a line into the coal fields of Jefferson County. W. J. McCann, of New Alexandria, has been securing right of way. It is the intention to haul coal as well as passengers.

COLUMBUS, OHIO.—The Columbus Railway Company has obtained another injunction restraining the county recorder from collecting the taxes as levied by the last board of equalization. The company reported its property as valued at $871,429, but the board of equalization increased this to $2,333,000.

COLUMBUS, OHIO.—Superintendent J. R. Harrigan, of the Columbus, Buckeye Lake & Newark Traction Company, has moved his headquarters from Columbus to Newark, although he will spend considerable time in Columbus. He is also superintendent of the Newark & Granville Railway and the Newark city lines.

CINCINNATI, OHIO.—Work has been started on the line of the Midland Traction Company which is to extend from Cincinnati to Milford and Loveland. Contracts are being placed for material, among them an order for 2600 tons of rails to the Carnegie Company. Eventually the road is to be extended to Columbus.

CLEVELAND, OHIO.—The Toledo, Fayette & Western Railway Company has been incorporated with $10,000 capital by F. C. McMillen, C. M. Stone and Luther Allen, of Cleveland; C. F. Franklin, J. R. Seagrave and F. E. Seagrave, of Toledo. The company will build an extension of the Toledo & Western Railway, now operating almost to Fayette.

STEUBENVILLE, OHIO.—The Steubenville, Mingoe & Ohio Valley Traction Company has been granted a 50-year franchise to build a new line to Mingoe. It is probable that when this line is built, the line by way of Altamont will be abandoned. The new line will be an expensive one to construct because of the necessity of immense retaining walls.

CLEVELAND, OHIO.—The Everett-Moore syndicate will shortly formulate a plan for refinancing the Northern Ohio Traction Company. Three plans are under consideration; two of them provide for the retirement of the preferred stock without the issuing of any new preferred stock. It is probable that the capital stock will be increased to $4,000,000 or $5,000,000.

CLEVELAND, OHIO.—H. A. Everett and J. C. Hutchins held a conference last week with Messrs. Black & Mulkey who own the Toledo & Monroe Railway. The Cleveland syndicate has now practically decided to retain the Detroit & Toledo Shore Line, and is again planning to buy back the Toledo & Monroe with a view of operating it in connection with the Shore Line. The plan is to consolidate both roads with the Detroit United Railway, of which Mr. Hutchins is president. The matter will be decided within a few days.

LIMA, OHIO.—The Ohio & Indiana Construction Company of Ft. Wayne has been incorporated with $600,000 capital stock by H. C. Paul and S. B. Fleming, of Ft. Wayne, L. G. Neely, of St. Marys, O.; S. T. Murdock, Lafayette, and J. W. VanDyke, of Lima. The company is chartered to build electric railways and it will take up the immediate construction of the Lima-Delphos-Van Wert & Ft. Wayne Traction Company's line. The parties mentioned are the chief promoters of the road. Practically all right of way has been secured and construction work is to start in the near future.

CLEVELAND, OHIO.—The Everett-Moore syndicate has completed a general plan for financing the Lake Shore Electric Railway. The plan has been accepted by the Cleveland banks which are to purchase a large block of bonds. As soon as it becomes operative, the road will be taken out of the hands of the receiver. The plan contemplates a general consolidated mortgage of $6,000,000. The company is now operating through service from Cleveland to Toledo and the property will be improved as rapidly as possible.

CLEVELAND, OHIO.—The Cleveland, Painesville & Ashtabula Railway Company has been fully financed and work of grading has been started between Painesville and Ashtabula. It is expected that one half of the road will be in operation before snow flies. The people who are building the road are the same as those who built the Toledo & Western Railway, one of the finest electric roads in the country. Officers are Luther Allen, president; W. J. Hayes, vice-president; E. B. Allen, secretary; Joseph Kraus, treasurer. Other directors are C. M. Stone and J. W. Holcomb.

CLEVELAND, OHIO.—The Northern Ohio Traction Company is planning to make extensive improvements in addition to those which have recently been mentioned in these columns. It is stated that fifty new cars will be ordered in the near future; some of them for the Akron city lines and others for the interurban lines. New ties are to be laid over the entire A. B. & C. line and the Barberton line is to be extended to Wadsworth. Work will start in the near future on the large steel bridge to be erected at the Gorge. The improvemnts planned for will cost in the neighborhood of a million dollars.

HARRISBURG, PA.—The Sharon & West Middlesex Electric Railway Company has been incorporated to build a line from Sharon to West Middlesex.

WINNSBORO, S. C.—A commission has been issued by the Secretary of State to the Winnsboro and Rock City Electric Railway Company, with headquarters at Winnsboro. The corporators named are: Thos. H. Ketchin, W. R. Rabb, T. K. Elliott, J. D. McCarley, J. O. Boag, J. E. McDonald and L. E. Owens. The capital stock of the street railway company is to be $50,000. The company proposes building a line of electric road from Winnsboro to certain granite quarries in Fairfield County.

NASHVILLE, TENN.—Nearly one year ago the employees of the Nashville Traction Company went on strike. The strike was finally settled a few days ago by the company agreeing to take the strikers back into its employ as fast as vacancies occur, and the labor union has in consequence removed the boycott on the road.

MEMPHIS, TENN.—The sale of 55 per cent. of the stock of the Union Railway Company of this city to George Gould, president of the Missouri Pacific, is announced. The amount of money involved in the transaction was $148,000. By this purchase of stock the Union Railway Company will be controlled by Mr. Gould, and the policy of the proposed belt line of the Union Railway Company will be shaped under his direction.

MORGANTOWN, W. VA.—Work has been started on the line of the Morgantown Street Railway. Work is under the direction of Walter L. Webb, of Chicago, as chief engineer.

NEW INDUSTRIAL COMPANIES.

THE NATIONAL ELECTRIC CLOCK COMPANY, of New York, has been incorporated; capital, $250,000. Directors: R. J. Stuart, New Hamburg; Joseph Butcher and W. L. Rose, New York.

THE DIELECTRIC MFG. CO. has recently been incorporated with a capital stock of $3,000. It is the intention to manufacture and test insulating materials. The office and factory will be in St. Louis. The present address is 3820 Manchester Square, that city. J. J. Kessler, Jr., is general manager.

THE NATIONAL LIGHT, HEAT AND POWER COMPANY has been incorporated at St. Louis, Mo. The capital stock is $1,500,000, and the incorporators are: Frank N. Gordon, Franklin C. Burdette, Jr., Fred L. McGahan, L. C. Spooner, George S. Robertson. The company proposes to develop oil fuel burners for all purposes.

OBITUARY.

MR. G. M. HOPKINS, one of the foremost technical journalists in the country, died in his summer home, The Cedars, in Cheshire, Mass., on August 17. He was taken ill while on a street car on Friday, and death resulted from uraemic poisoning. The body is to be taken to Albion, N. Y., for burial. Mr. Hopkins was prominent as a patent attorney and conspicuous in scientific work. He was the author of "Experimental Science," a handbook used in schools, and was at work on a revision this summer. As one of the editors of "The Scientific American," he had charge of the electrical department. He conducted also the department of questions and answers. His work and personality were highly appreciated by a wide circle of friends and admirers. He left a widow and son. The latter was connected formerly with "The Scientific American," but is now president of the Cosmos Company.

LEGAL.

CLEVELAND THREE-CENT FARES.—Mayor Johnson's three-cent fare plans for Cleveland street railways have been effectually blocked. On Aug. 15 the Supreme Court tied up the City Council by granting an injunction asked for by the attorneys of the two street railway systems of Cleveland. The Council was some time ago about to pass a three-cent fare franchise ordinance when an injunction stopped it. The Circuit Court dissolved the injunction, but the opposition carried it to the Supreme Court and that body has continued the injunction until a full hearing can be given the matter. If the Supreme Court sees fit it can hold the case until next spring. This means that three-cent fare in Cleveland is blocked, perhaps for a long time, as the legislature in special session may remove franchise-granting powers from the present Council.

PERSONAL.

MR. GEORGE WESTINGHOUSE, JR., returned from England this week on the "Kronprinz Wilhelm."

DR. FREDERICK BEDELL, of Cornell University, will reach New York the first week in September, after a year's travel in Europe.

MR. D. MAZENET, of the City of Mexico, managing director of the Mexican General Electric Company, which looks after the interests of the General Electric Company in the republic, has left New York for Mexico after a few weeks' visit to the United States.

MR. HENRY SCHROEDER, E. E., graduate of Columbia University, class of 1899, formerly with the Edison Electric Illuminating Company of New York, has recently been elected treasurer of Thompson, Son & Co., New York. He represents the new interests lately taken in by J. H. Thompson, Jr.

MR. THOMAS ROCHE.—After more than a score of years' service as superintendent of the Western Union Telegraph Company in Boston, Mr. Thomas Roche has resigned, September 1 being the date named for the change to take effect. It is expected that C. E. Page, of Cincinnati, will be appointed superintendent in his place.

MR. H. H. VREELAND, president of the Metropolitan and Interurban Street Railway Companies of New York, gave a large garden party and Rhode Island clambake at his beautiful country residence at Brewsters, N. Y., on August 16, to the numerous heads of departments and members of his staff, as well as the local authorities and friends. It was a most enjoyable affair.

MR. M. H. BENTLEY, chief engineer of the International Telephone Manufacturing Company, Chicago, has just returned from an extended tour through England and the principal countries of Europe, where he has been making a careful study and investigation of the telephone field, and the possibilities of equipment from this country. Mr. Bentley is well known in the electrical and telephone field, as one of the foremost experts in his line, and well fitted for a trip of this kind.

PROF. R. S. HUTTON, of Owens College, Manchester, Eng., has arrived in the United States, and during his stay here will inspect the principal electrochemical college laboratories and manufacturing works of the country. Owens College, the director of which is Prof. Arthur Schuster, Ph. D., F. R. S., has given electrochemistry and electrometallurgy a prominent position in its curriculum. In addition to the regular course in these branches, there is a Saturday afternoon course for the benefit particularly of metallurgists engaged in steel works, and an evening course intended generally for those engaged in electrochemical pursuits.

Trade Notes.

SLATE LININGS.—Messrs. Zimdars & Hunt, New York, have issued a catalogue (No. 3) giving prices of slate linings for panel board cabinets.

THE ANDERSON ELECTRIC COMPANY has leased the Southeast corner of 21st Street and Washington Ave., St. Louis, Mo.; and is having plans made for the erection of a six-story factory building which will be completed by the first of next January at a cost of about $125,000.

SWITCHES.—The W. S. Hill Electric Company, New Bedford, Mass., has just issued Bulletins Nos. 115, 117 and 118 devoted, respectively, to voltmeter and ammeter switches, railway feeder cut-out boxes and "Pioneer" switches. These various devices are illustrated.

SUNBEAM LAMPS.— There is every indication that all records will be broken in the sale of the well-known Sunbeam lamp during the next few months. The factory product shows a steady improvement in quality each month, and those who are not familiar with the Sunbeam lamp will do well to give it a trial.

THOMPSON, SON & CO.—The business of this firm has grown to such an extent that increased facilities are needed all round. The factory and storerooms at 90 Verona Street, Brooklyn, are filled and running to full capacity. The company reports closing lately some of the largest deals in the second-hand machinery business.

NEW FIRM.—The firm of Dittrick & Jordan, of Cleveland, Ohio, has been formed for the purpose of handling electric railway supplies and general repairs. Mr. Dittrick was formerly superintendent of the armature winding department of the Cleveland City Railway Company's shops. Mr. Jordan is superintendent of the Cleveland, Painesville & Eastern. The firm will extend the business which Mr. Dittrick started some time ago and the facilities of their shop will be enlarged for repair work of all kinds.

ELECTRIC APPLIANCE COMPANY'S CATALOGUES.—A new general supply catalogue (No. 16); a new telephone and telephone supply catalogue (No.

17); a new catalogue of Gutmann alternating current wattmeters and a new catalogue showing full line of rubber covered wires and cables, have just been issued by the Electric Appliance Company, Chicago.

RUBBER COVERED WIRES.—The Indiana Rubber & Insulated Wire Company, Jonesboro, Ind., has just issued a catalogue of its "Paranite" and "Peerless" rubber covered wires and cables. The catalogue has 48 pages, is illustrated and is 4¾x7¼ in dimensions. The cover is very artistically executed, the design and lettering representing relief work.

THE W. C. YOUNG MFG. CO., 17 Hermon Street, Worcester, Mass., has recently added several new machines to its line of lathes, viz.: 13 in. engine lathes; 14 in. hand lathe and double-geared shear, and will shortly add a new 12 in. lathe. Its line of iron working machinery, lathes, punches and shears is briefly described and illustrated in a catalogue of recent issue. The catalogue contains tables of dimensions and price-lists of the various machines.

MINIATURE LAMPS.—The miniature catalogue on miniature lamps put out by the American Miniature & Decorative Lamp Co., 436 and 438 Broome Street, New York, is a handsome publication. It is made in vest pocket size and is a splendid illustration of the fact that an immense amount of useful and interesting matter can, when desired, be placed in a small space. An electrical worker handling small lamps would find it profitable to have one of these little catalogues for ready reference.

ELECTRICAL AND STEAM MACHINERY.—Rossiter, MacGovern & Co. (Inc.), 141 Broadway, New York, have just issued a 36-page booklet containing a list of electrical and steam machinery they now have on hand. A complete steam and electrical equipment can be obtained from this stock, which is such a varied one that it would be difficult to not find what is wanted. The firm has recently largely increased its business facilities, and has opened branch offices in Boston and St. Louis. These offices are in charge of Robert J. Randolph, Jr., and J. A. Pierce, respectively.

THE STANDARD POLE & TIE COMPANY, No. 44 Broad Street, New York City, has recently opened another cross-arm mill in the South. It has a large stock of standard arms already milled and its facilities for turning out arms according to special specifications is excellent. All arms are carefully inspected before shipment. Among its regular customers for cross-arms are the General Electric Company, the Central New York Telephone & Telegraph Company, the Empire State Telephone & Telegraph Company, the Hudson River Telephone Company, and the Diamond Electric Company, of Philadelphia.

THE CLONBROCK STEAM BOILER COMPANY, of Brooklyn, N. Y., has issued a new edition of its catalogue devoted to the Morrin "Climax" vertical water-tube safety boiler. It is a handsome pamphlet of 170 pages and contains a large number of illustrations of plants in which this interesting type of boiler has been installed. A great many of these plants are for electric light and power and electric railway purposes, and a large number of testimonials are adduced as to the excellent results obtained in the performance of these boilers. The pamphlet includes reports of several tests and quotes also from the testimony under oath of Mr. Edison as to his high opinion of this type of boiler. The back part of the pamphlet embodies much useful data and information as to the steam, fuel, piping, grate service, etc.

THE BAY COUNTIES POWER COMPANY, of San Francisco, has just issued in a very handsome *edition de luxe* form a collection of several articles by Mr. George P. Low, devoted to its electrical power transmission system. It is a superb quarto bound in stout board covers and using highly glazed coated paper which brings out the values of the halftones most artistically. As will be remembered, the Bay Counties plant, operated by the Standard Electric Company of California, involves the longest power transmission in the world, namely, 220 miles from the Sierras to San Francisco, and Mr. Low has treated every phase of the subject in a most interesting and graphic manner. The pamphlet is indeed a valuable addition to the literature of the power transmission subject, and loses nothing from being written in a style which is more or less popular in its method of treatment. There is a great variety of data embodied, however, in the book.

COLLEGE DEGREES FOR CORRESPONDENCE SCHOOL STUDENTS.—The American School of Correspondence has recently made an arrangement whereby the students are admitted to the classes of one of the great resident technical schools without further examination, and their work counts towards a degree of B.S. This shows in a striking manner the wonderful advance in the standard of correspondence work in the past few years, and marks a new era in the educational possibilities of the common people. Ambitious young men who are too poor to give up four years to obtain a college degree can now do part of their work at home, and, in this way, finish with a few years at a resident technical school. In this connection the free scholarship withdrawal announcement of the American School in last week's issue is of great interest, for it ends one of the greatest educational opportunities of the year. The trustees of the American School of Correspondence, Boston, Mass., have been offering a limited number of free scholarships to deserving young men for the purpose of securing a few representative students in the large shops. The school now announces that after September 30th no more free scholarships will be awarded. This is a good opportunity for a bright young man to get a course in mechanical, steam, textile and sanitary engineering (including heating, ventilation and plumbing) and mechanical drawing. Tuition to successful applicants is entirely free, the only expense being (as in all schools) for postage and instruction papers. A postal card addressed to the school will bring any information that may be desired.

WESTERN ELECTRIC PICNIC.—A most successful picnic was enjoyed on Saturday, August 9, 1902, by the drafting department of the Western Electric Company. A special car having been engaged, a party of 80 went by train to Cedar Lake, Ind. The ride was enlivened by music and singing furnished by an orchestra, ably supplemented by members of the party; Mr. Peloubet being chief performer of the home team. A steamer conveyed the party across the lake to Cedar Point Hotel, where arrangements had been prepared beforehand for having a good time. The party then proceeded to take possession of the hotel and grounds, and sports were soon in full swing. The ball game was won, after an exciting contest, by the team captained by Mr. Krivanek. The 100 yards dash brought about 30 entries, the winner being Mr. T. Nelson. The swimming race was captured by Mr. R. S. Hawkins. The event of the day was the tug of war between four departments; this was won by the telephone switchboard department, their opponents in the final round being the dynamo department, the latter having to give way to the superior avoirdupois of the victors. The running long jump produced great excitement and was captured by Mr. A. Olsen, after a hard struggle. The dinner bell was then heard and the party adjourned to the large dining hall of the hotel, where full justice was done to a good dinner, Messrs. Harper and Tapley occupying the places of honor at the table. The dinner was enlivened by music from the orchestra and a cake walk executed by a member of the staff. While coffee and cigars were being discussed, some speech making was indulged in, followed by presentation of prizes to the successful competitors of the various contests. Some photographs having been taken, the party proceeded to cross the lake and returned to Chicago by their special car.

Record of Electrical Patents.

UNITED STATES PATENTS ISSUED AUGUST 12, 1902.

[Conducted by Wm. A. Rosenbaum, Patent Attorney, 140 Nassau St., N. Y.]

706,508. ARMATURE WINDING FOR INDUCTION MOTORS; A. H. Armstrong, Schenectady, N. Y. App. filed Nov. 3, 1897. The conductors are made of drawn metal and have end connections cast integrally therewith in closed circuit relation.

706,527. ELECTRIC SWITCH; E. R. Carihoff, East Orange, N. J. App. filed Feb. 8, 1901. A "face contact" switch in which the contacts have a sliding motion with relation to each other after the initial contact is made and before the final contact is broken.

706,529. ELECTROCHEMICAL APPARATUS; C. C. Clark, Philadelphia, Pa. App. filed Sept. 20, 1901. (See Current News and Notes.)

706,540. ELECTRICALLY CONTROLLED SWITCH; W. L. R. Emmet, Schenectady, N. Y. App. filed Nov. 3, 1899. Comprises fixed contact terminals adapted to be bridged by contacts in a pivoted arm controlled by a magnet. Also has auxiliary shunting contacts to absorb spark of rupture.

706,544. SYSTEM OF ELECTRICAL DISTRIBUTION; R. Fleming, Lynn, Mass. App. filed Jan. 26, 1900. Provides for an increase in the number of translating devices which may be fed from a given series circuit by inserting a plurality of step-up transforming devices in the circuit and feeding a translating device from each of the transforming devices.

706,545. ELECTRIC ARC LAMP; R. Fleming, Swampscott, Mass. App. filed Nov. 23, 1901. Provides a combined spring and insulating support whereby vibrations will be absorbed and danger from short circuit prevented.

706,547. ELECTRIC ARC LAMP; F. A. Gilbert, Brookline, and E. O. Lundin, Beachmont, Mass. App. filed March 24, 1898. Details relating to means for preserving electrical contact at all times between the movable carbon and the actuating means for the same.

706,553.—PROCESS OF MANUFACTURING ALUMINA; C. M. Hall, Niagara Falls, N. Y. App. filed Aug. 10, 1901. (See Current News and Notes.)

706,555. ELECTRIC METER; C. D. Haskins, Schenectady, N. Y. App. filed Feb. 13, 1901. Improvements on U. S. Patent No. 653,806, July 17, 1900.

706,559. ELECTRIC TRANSMISSION OF POWER; E. M. Hewlett, Schenectady, N. Y. App. filed Nov. 23, 1901. Aims to avoid suspension of service during repairs to the system, by providing duplicate transmitting mains connected in parallel at a local distributing point and differential means responsive to both mains for automatically opening the damaged main in case the two sides become unbalanced.

706,567. TELEPHONE CABLE CONNECTION; T. P. Jones, Olyphant, Pa. App. filed June 27, 1901. (See page 293.)

706,568. ELECTRODE FOR STORAGE BATTERIES; C. W. Kennedy, Rutledge, Pa. App. filed July 30, 1901. A grid for storage battery electrodes comprising a frame provided with recesses to receive the material to become active, and having series of horizontal and vertical members forming said recesses, each of said vertical members being disposed opposite one or more of said recesses and serving to resist the pressure caused by the expansion of the active material during the "forming" period.

706,575. MULTIRATE METERING SYSTEM; A. D. Lunt, Schenectady, N. Y. App. filed Jan. 31, 1901. (See Current News and Notes.)

706,577. ELECTRIC SWITCH FOR FLASHING LIGHTHOUSE LANTERNS; F. Mackintosh, Schenectady, N. Y. App. filed Jan. 9, 1899. A rotating switch is provided to switch the current from the lantern to an artificial load alternately.

706,578. MARINE LIGHT FIXTURE; G. L. Martin, New York, N. Y. App. filed Dec. 10, 1900. Details.

706,581. ELECTRIC SWITCH; F. A. Merrick, Johnstown, Pa. App. filed June 26, 1901. Details.

706,586. AUTOMATIC ELECTROMECHANICAL SEMAPHORE SIGNAL; J. J. McGill, Chicago, Ill. App. filed Aug. 19, 1901. Details of a system in which a signal is set to "danger" mechanically by the moving train, and to "safety" by electrical devices also controlled by train on leaving the block.

706,591. SYSTEM OF ELECTRIC DISTRIBUTION; H. F. Parshall, London, Eng. App. filed Dec. 7, 1899. (See Current News and Notes.)

706,598. ROTARY TRANSFORMING APPARATUS; E. W. Rice, Schenectady, N. Y. App. filed Dec. 30, 1899. The armature core is provided with two sets of slots, one set consisting of numerous small slots and the other set of a fewer number of large slots. A winding located in the set of small slots is connected with a commutator and a winding of finer wire, the coils of which are separately formed and insulated, is located in the larger slots and connected to the alternating current terminals.

706,599. ELECTRIC CABLE; T. Rosati, Florence, Italy. App. filed Jan. 30, 1901. Details of a coupling for a cable.

706,602. THERAPEUTIC ELECTRICAL APPARATUS; I. E. Shaffer, Mount Vernon, N. Y. App. filed Nov. 27, 1901. Comprises an instrument adapted to convey a liquid to the part of the body to be treated, means to electrically charge the flowing liquid and a spherical terminal provided with perforations so disposed as to disperse the liquid over a large area.

706,607. SYSTEM OF ELECTRICAL DISTRIBUTION; C. P. Steinmetz, Schenectady, N. Y. App. filed Jan. 2, 1901. Relates to certain improvements in constant-potential constant-current transforming devices in which the desired transformation is effected by the employment of suitable combinations of inductances and condensers. Instead of connecting the constant-current circuit directly to terminals of the condensers and inductances, the connection is made inductively through the agency of suitable transforming devices.

706,608. SYSTEM OF ELECTRICAL DISTRIBUTION; C. P. Steinmetz, Schenectady, N. Y. App. filed Jan. 2, 1901. Relates to transforming devices of the class in which combinations of reactance devices of opposite signs are used for changing alternating-current at constant potential into alternating current of constant volume, or the reverse. It comprises constant potential mains, reactances of opposite sign connected in series across the mains, a consumption circuit operatively connected across the reactances, and an additional reactance operatively connected in shunt to said mains.

706,609. SYSTEM OF ELECTRICAL DISTRIBUTION; C. P. Steinmetz, Schenectady, N. Y. App. filed Jan. 2, 1901. Provides for automatic means for maintaining a practically constant consumption of power in consumption circuits, the aggregate resistance of which is variable. It comprises constant potential mains, reactances of opposite sign in series across the mains, a non-inductive energy consuming device operatively connected across one of the reactances, and another energy consuming device across another of the reactances.

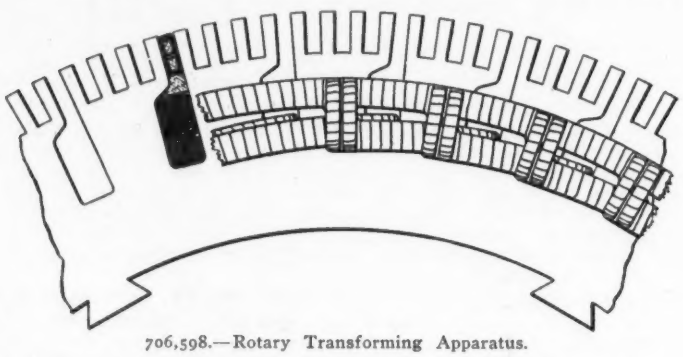
706,612. ELECTRIC METER; E. Thomson, Swampscott, Mass. App. filed Jan. 18, 1900. (See page 293.)

706,631. CHEMICAL GENERATOR OF ELECTRICITY; E. L. Anderson, St. Louis, Mo. App. filed Sept. 30, 1901. Consists of a cell in which there are an aluminum electrode, a negative electrode, and an electrolyte in contact with both of said electrodes containing a suitable halogen salt and nitric acid.

706,632. ARMATURE WINDING FOR INDUCTION MOTORS; A. H. Armstrong, Schenectady, N. Y. App. filed Nov. 3, 1897. A cast-metal grid comprising a plurality of conductors united by web connections at their ends, the grid being adapted to be wrapped around an armature core and secured thereon.

706,735. WIRELESS TELEGRAPHY; R. A. Fessenden, Allegheny, Pa. App. filed Dec. 15, 1899. (See page 289 for account of this and 12 following patents.)

706,736. APPARATUS FOR WIRELESS TELEGRAPHY; R. A. Fessenden, Allegheny, Pa. App. filed May 17, 1900. Renewed Nov. 29, 1901.



706,598.—Rotary Transforming Apparatus.

706.737. WIRELESS TELEGRAPHY; R. A. Fessenden, Allegheny, Pa. App. filed May 29, 1901.

706,738. WIRELESS TELEGRAPHY; R. A. Fessenden, Allegheny, Pa. App. filed May 29, 1901.

706,739. CONDUCTOR FOR WIRELESS TELEGRAPHY; R. A. Fessenden, Allegheny, Pa. App. filed May 29, 1901.

706,740. WIRELESS SIGNALING; R. A. Fessenden, Manteo, N. C. App. filed Sept. 28, 1901.

706,741. APPARATUS FOR WIRELESS TELEGRAPHY; R. A. Fessenden, Manteo, N. C. App. filed Nov. 5, 1901.

706,742. WIRELESS SIGNALING; R. A. Fessenden, Manteo, N. C. App. filed June 6, 1902.

706,743. WIRELESS SIGNALING; R. A. Fessenden, Manteo, N. C. App. filed June 26, 1902.

706,744. CURRENT ACTUATED WAVE RESPONSIVE DEVICE; R. A. Fessenden, Manteo, N. C. App. filed July 1, 1902.

706,745. SIGNALING BY ELECTROMAGNETIC WAVES; R. A. Fessenden, Manteo, N. C. App. filed July 1, 1902.

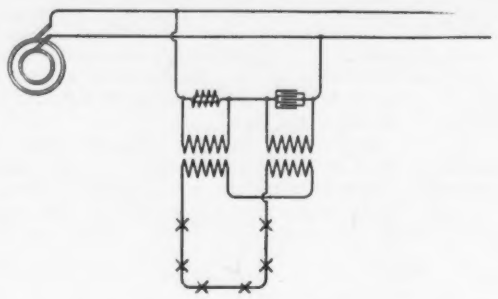
706,746. SIGNALING BY ELECTROMAGNETIC WAVES; R. A. Fessenden, Manteo, N. C. App. filed July 1, 1902.

706,747. APPARATUS FOR SIGNALING BY ELECTROMAGNETIC WAVES; R. A. Fessenden, Manteo, N. C. App. filed July 22, 1902.

706,759. ELECTRICAL SWITCH OR CUT OFF; P. Kennedy, Brooklyn, N. Y. App. filed Dec. 4, 1901. Covers the use of a sheet of metallic gauze over the face of the terminals, and other details.

706,786. DEVICE FOR STRINGING ELECTRIC WIRES; J. W. Seaman, Bay City, Mich. App. filed Jan. 14, 1902. Structural details.

706,798. ELECTRIC TESTING APPARATUS; P. E. Chapman, St. Louis, Mo. App. filed Dec. 4, 1901. The invention consists in placing a transformer, preferably of the auto type, in series with an incandescent lamp,



706,607.—System of Electrical Distribution.

and by means of an adjustable ratio of transformation transform the lamp current to a value that will be greatly affected by the impedance of the work and react on the lamp.

706,817. ELECTRIC CLOCK; H. Gillette, Highland Park, Ill. App. filed June 24, 1899. Relates to improvements in clocks employing a gravitating impelling device which acts against the pendulum or equivalent time measuring vibrator during a portion of the vibratory movement thereof in one direction and is raised to its normal position after such action by an electromagnet, the circuit of the electromagnet being made and broken under the movement of the pendulum.

706,870. HANGER FOR TRANSFORMERS OR THE LIKE; J. J. Wood, Fort Wayne, Ind. App. filed Nov. 29, 1901. (See Current News and Notes.)

706,923. LAMP; C. E. Gervais, New York, N. Y. App. filed April 17, 1902. Details.

706,924. LAMP; C. E. Gervais, New York, N. Y. App. filed April 17, 1902. Details.

706,927. ELECTRICAL FLOOR KEY; E. C. Goodrich, Houghton, Mich. App. filed April 21, 1902. Details.

706,974. CONDUIT FOR ELECTRIC WIRES; R. W. Lyle, Perth Amboy, N. J. App. filed April 10, 1902. Relates to means for aligning and locking together the respective sections of the conduit.

706,982. GALVANOMETER; C. L. R. E. Menges, Hague, Netherlands. App. filed Dec. 23, 1897. According to this invention a galvanometer is provided wherein the magnetic field is controlled by means of the attraction of one part of the magnetic circuit upon another part in combination with means for varying the magnetic flux.

707,007. MULTIPLE TELEGRAPHY; M. I. Pupin, New York, N. Y. App. filed Feb. 23, 1894. (See page 292.)

707,008. MULTIPLE TELEGRAPHY; M. I. Pupin, Yonkers, N. Y. App. filed Dec. 29, 1897. (See page 292.)

707,049. TERMINAL BOX FOR PROTECTED ELECTRICAL CIRCUITS; F. B. Cook, Chicago, Ill. App. filed May 21, 1902. (See page 293.)

707,050. ELECTRICAL PROTECTOR SET; F. B. Cook, Chicago, Ill. App. filed May 21, 1902. (See page 293.)

707,051. SYSTEM OF STRONG CURRENT PROTECTION; F. B. Cook, Chicago, Ill. App. filed May 21, 1902. (See page 293.)

707,052. REGULATION OF ELECTRIC LIGHTING SYSTEMS; J. J. Creveling, New York, N. Y. App. filed July 17, 1901. Provides electric means for compensating for the lag of the mechanical governor of regulator for the generator.

707,055. CABLE SLEEVE; C. M. Earl, Detroit, Mich. App. filed Dec. 6, 1901. Details for a water-tight sleeve for covering a cable splice or joint.

707,056. AUTOMATIC SELECTIVE SYSTEM; C. D. Ehret, Philadelphia, Pa. App. filed Jan. 10, 1902. Comprises an automatic selecting device whereby one station may be put into communication with any other of a series or group, each station always transmitting messages by energy of a definite frequency or frequencies.

707,064. WIRELESS TELEGRAPHY; H. Shoemaker, Philadelphia, Pa. App. filed June 1, 1901. A receiving apparatus consisting of a series of coherers in the same main circuit and in parallel, and a decohering device for each coherer, the decohering devices being dependent upon the action of the coherers, one being operated when the coherers conduct and the other when one of the coherers has been decohered.

12,019. (Reissue.) ELECTROCHEMICAL GENERATOR; H. S. Amwake, Camden, N. J. App. filed June 17, 1902. An electrochemical generator consisting of a single fluid cell, provided with a positive electrode and a negative fixed electrode, an electrolyte, and a current conducting baffle-partition in said electrolyte, between said electrodes and normally insulated therefrom.